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# TRANSPORT ALGORITHMS FOR PREMIXED, LAMINAR STEADY STATE FLAMES

T. P. Coffee J. M. Heimerl

March 1981



# US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND BALLISTIC RESEARCH LABORATORY ABERDEEN PROVING GROUND, MARYLAND

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The effects of different methods of approximations and approximation and approximation and approximations are approximately appr						
phenomena in models of premixed, laminar, steady-state flames have been studied.						
Five approximation methods that span a wide range of computational complexity are developed. Identical data for individual species properties have been used						
for each method. Each approximation method is employed in the numerical solution						
of a set of five H <sub>2</sub> -O <sub>2</sub> -N <sub>2</sub> flames. For each flame the computed species and tem-						
perature profiles, as well as the computed flame speeds are found to be very						
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#### 20. ABSTRACT (Cont'd)

nearly independent of the approximation method used. This does not indicate that transport phenomena are unimportant, but rather that the selection of the input values for the individual species transport properies is more important than the selection of the method used to approximate the multispecies transport.

Based on these results we have developed a sixth approximation method that is computationally efficient and which provides results extremely close to the most sophisticated and precise method used.

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#### INTRODUCTION

To determine validated sets of elementary chemical reactions for use in predictive combustion models, we have chosen to simulate the one dimensional, premixed, laminar flame. This approach has the advantage that the predicted temperature and species profiles can in principal be compared with suitable burner experiments of the same flame. The corresponding equations are derived by Bird, Stewart and Lightfoot, and by Williams, and are given in Appendix A.

Such a simulation requires as input not only the kinetics information (of our immediate interest), but also thermodynamic and transport data. Fortunately the thermodynamics input is by and large well defined. 3,4 In addition, while some transport coefficients are only well defined through low temperature (< 1000 K) measurements, 5 the theory is sufficiently developed to allow reasonable estimates to be made at higher temperatures. A theory has been developed for multicomponent

<sup>&</sup>lt;sup>1</sup>R. B. Bird, W. S. Stewart and E. N. Lightfoot, <u>Transport Phenomena</u>, John Wiley and Sons, NY, (1960).

 $<sup>^2</sup>$ F. A. Williams, Combustion Theory, Addison-Wesley, Reading, MA, (1965).

<sup>&</sup>lt;sup>3</sup>D. R. Stull and H. Prophet, <u>JANAF Thermochemical Tables</u>, 2nd Edition, NSRDS-NBS-37, June 1971.

<sup>&</sup>lt;sup>4</sup>S. Gordon and B. J. McBride, "Computer Program for Calculation of Complex Chemical Equilibrium Compositions, Rocket Performance, Incident and Reflected Shocks and Chapman-Jouguet Detonations", NASA-SP-273, (1971), (1976 program version).

<sup>&</sup>lt;sup>5</sup>Y. S. Touloukian, P. E. Liley, and S. C. Saxena, <u>Thermophysical</u> <u>Properties of Matter</u>, Vol. 3, Thermal Conductivity (Normetallic Liquids and Gases), IFI/Plenum, NY-Washington, (1970).

 $<sup>^6</sup>$ J. O. Hirshfelder, C. F. Curtiss and R. B. Bird, Molecular Theory of Gases and Liquids, 2nd printing, corrected, with notes, John Wiley and Sons, NY, (1964).

mixtures, 6-10 but it is computationally cumbersome. To circumvent this, previous workers have generally employed some level of simplification. 11-21

7C. S. Wang Chang, G. E. Uhlenbeck and J. deBoer, Studies in Statistical Mechanics, Vol. 2, John Wiley and Sons, NY, (1964).

8 L. Monchick, K. S. Yun and E. A. Mason, "Formal Kinetic Theory of Transport Phenomena in Polyatomic Gas Mixtures", J. Chem. Phys., 39, 654-699 (1963).

 $^9$ L. Monchick, A. N. G. Pereira and E. A. Mason, "Heat Conductivity in Polyatomic and Polar Gases and Gas Mixtures", J. Chem. Phys.,  $\underline{42}$ , 3241–3256 (1965).

<sup>10</sup>L. Monchick, R. J. Munn and E. A. Mason, "Thermal Diffusion in Polyatomic Gases: A Generalized Stefan-Maxwell Diffusion Equation", J. Chem. Phys., 45, 3051-3058 (1966).

<sup>11</sup>G. Dixon-Lewis, et al., "Flame Structure and Flame Reaction Kinetics", Proc. R. Soc., London A 317, 235-263 (1970); A 330, 199-218 (1972); A 331, 571-584 (1973); and A 346, 261-278 (1975).

12G. Dixon-Lewis, "Kinetic Mechanism, Structure and Properties of Premixed Flames in Hydrogen-Oxygen-Nitrogen Mixtures", Phil. Trans. R. Soc., London, 292, 45-99 (1979).

<sup>13</sup>G. Tsatsaronis, "Prediction of Propagating Laminar Flames in Methane, Oxygen, Nitrogen Mixtures", Combust. and Flame, <u>33</u>, 217-239 (1978).

14 J. Warnatz, "Calculation of the Structure of Laminar Flat Flames 1; Flame Velocity of Freely Propagating Ozone Decomposition Flames", Ber. Bunsenges Phys. Chem., 82, 193-200 (1978).

<sup>15</sup>D. B. Spalding and P. L. Stephenson, "Laminar Flame Propagation in Hydrogen + Bromine Mixtures", Proc. R. Soc. London A, 324, 315-337 (1971).

<sup>16</sup>P. L. Stephenson and R. G. Taylor, "Laminar Flame Propagation in Hydrogen, Oxygen, Nitrogen Mixtures", Combust. and Flame 20, 231-244 (1973).

L. D. Smoot, W. C. Hecker, and G. A. Williams, "Prediction of Propagating Methane-Air Flames", Combust. and Flame 26, 323-342 (1976).

J. Warnatz, "Calculation of the Structure of Laminar Flat Flames II; Flame Velocity and Structure of Freely Propagating Hydrogen-Oxygen and Hydrogen-Air Flames", Ber. Bursenges Phys. Chem., 82, 643-649 (1978).

<sup>19</sup>D. B. Spalding, P. L. Stephenson, and R. G. Taylor, "A Calculation Procedure for the Prediction of Laminar Flame Speeds", Combust. and Flame 17, 55-64 (1971).

L. Bledjian, "Computation of Time-Dependent Laminar Flame Structure", Combust. and Flame, 20, 5-17 (1973).

 $^{21}$ E. Cramarossa and G. Dixon-Lewis, "Ozone Decomposition in Relation to the Problem of the Existance of Steady-State Flames", Combust. and Flame  $\underline{16}$ , 243-251 (1971).

Pla

This paper addresses the question: which of the <u>mathematical</u> approximations to the multicomponent transport properties provides a desirable trade-off between precision and computational effort. Another way of phrasing this question is to ask what loss in precision of predicted flame speeds and profiles occurs as the mathematical approximations to the multicomponent, polyatomic transport expressions are made cruder.

We approach this problem by actually computing the flame properties for a given flame with a fixed set of input conditions. The transport algorithms are varied and the resulting flame speeds and profiles compared. The numerical method is discussed in references 22 and 23. We have selected the  $H_2$ - $O_2$ - $N_2$  system as the candidate flame because it has a well characterized set of input parameters. (See Appendix B).

This paper is divided into the following sections. Section II outlines a sequence of five methods for approximating the transport coefficients. Section III shows the numerical results of these approximation methods relative to the most accurate method, and Section IV discusses their relative precision for a set of five flames. Based on these results, we outline in Section V an algorithm which provides a reasonable balance between computational effort and theoretical rigor and includes a crude approximation for the effects of thermal diffusion. There are several appendices that contain sufficient detail to reproduce our computations.

#### II. APPROXIMATION METHODS

In this section we outline five approximations to the multicomponent, polyatomic formalism, based on the theory of Wang Chang and Uhlenbeck.  $^{6-10}$  We start with the most accurate and progressively consider cruder approximations. Method I is the three term Sonine approximation to the formalism. Dixon-Lewis (DL) $^{24}$  gives a discussion of this approximation, and we will generally follow his approach. Method II involves a level of approximation using smaller matrices. Methods III and IV use

<sup>&</sup>lt;sup>22</sup>T. P. Coffee and J. M. Heimerl, "A Method for Computing the Flame Speed for a Laminar, Premixed, One Dimensional Flame", BRL Technical Report, ARBRL-TR-02212, Jan 80.

<sup>&</sup>lt;sup>23</sup>T. P. Coffee, "A Computer Code for the Solution of the Equations Governing a Laminar, Premixed, One Dimensional Flame", BRL Memorandum Report, to be published.

 $<sup>^{24}</sup>$ G. Dixon-Lewis, "Flame Structure and Flame Reaction Kinetics II. Transport Phenomena in Multicomponent Systems", Proc. Roy. Soc. A  $\underline{307}$ , 111-135 (1968).

non-matrix techniques. Method V discusses the case of constant transport parameters. In each case we need to determine the diffusion velocities  $V_i$ , i = 1, 2, ... N, and the heat flux q.

#### A. Method I

Following (DL), we can write

$$q = \sum_{i=1}^{N} \rho Y_{i} V_{i} h_{i} - \lambda_{o} \frac{\partial T}{\partial x} - \sum_{i=1}^{N} \frac{RTD_{i}^{T}}{M_{i}^{Y}_{i}} \frac{\partial X_{i}}{\partial x}$$
(1)

and

$$V_{i} = \frac{1}{X_{i}} \sum_{j=1}^{N} \frac{Y_{j}}{X_{j}} D_{ij} \frac{\partial X_{j}}{\partial x} - \frac{D_{i}^{T}}{\rho Y_{i}} \frac{\partial}{\partial x} (\ln T), \qquad (2a)$$

or

$$V_{i} = V_{i} + W_{i}, \tag{2b}$$

a notation we will later find convenient. The diffusion coefficients can be written in terms of the Sonine expansion coefficients,

$$D_{ij} = X_{i} \frac{16T}{25p} \frac{\sum_{k=1}^{N} M_{k} X_{k}}{M_{j}} c_{i00}^{1ji}$$
(3)

and

$$D_{i}^{T} = \frac{8}{5} \frac{M_{i}X_{i}}{R_{a}} \quad a_{i00}^{1} \quad . \tag{4}$$

Substituting equations (3) and (4) into equation (2) we find

$$V_{i} = \frac{16T}{25p} \sum_{j=1}^{N} (c_{i00}^{1ji} \frac{\partial X_{j}}{\partial x}) - \frac{8T}{5p} a_{i00}^{1} \frac{\partial}{\partial x} (\ln T)$$
 (5)

Similarly, we can write

$$\lambda_{o} = \lambda_{o,tr} + \lambda_{o,int} = -4 \sum_{i=1}^{N} X_{i} a_{i10}^{1} - 4 \sum_{i=1}^{N} X_{i} a_{i01}^{1}$$
 (6)

The diffusion velocities and the heat flux are now defined in terms of the  $a^1_{i00}$ ,  $a^1_{i10}$ ,  $a^1_{i01}$ , and  $c^{lji}_{i00}$ . If we use three terms in the polynominal expansion, these are defined implicitly by the equations

(L) 
$$(a_{100}^1 \dots a_{N00}^1, a_{110}^1 \dots a_{N10}^1, a_{101}^1 \dots a_{N01}^1)^T$$
  
=  $(0 \dots 0, X_1 \dots X_N, X_1 \dots X_N)^T$  (7)

and

(L) 
$$(c_{100}^{1hk} cdot c_{N00}^{1hk}, c_{110}^{1hk} cdot c_{N10}^{1hk}, c_{101}^{1hk} cdot c_{N01}^{1hk})^{T}$$
  
=  $(\delta_{1h} - \delta_{1k} cdot \delta_{Nh} - \delta_{Nk}, 0 cdot 0, 0 cdot 0) h, k = 1 cdot N.$  (8)

The elements of the 3N by 3N matrix (L) are given in Appendix C. The procedures we have used for computing these elements are discussed in Appendix D.

From equation (8), it appears that we must solve  $N^2$  sets of equations to obtain the  $c_{100}^{1ji}$ . In fact, it has been recommended that only the a terms be computed using this level of approximation, and that the c terms be computed using a one term expansion (see Method II).

However, this is not necessary if we observe that we are only interested in the  $V_1$ 's, and not directly in the c terms. We can convert the c-vector in equation (8) to a vector whose elements are in fact the  $V_1$  by multiplying each equation of (8) by  $\frac{16T}{25p} \frac{\partial X_h}{\partial x}$  and then summing over h. After some algebra we find

(L) 
$$(V_1 \dots V_N, \dots)^T = (\frac{16T}{25p} \frac{\partial X_1}{\partial x} \dots \frac{16T}{25p} \frac{\partial X_N}{\partial x}, 0 \dots 0, 0 \dots 0)^T$$
 (9)

Equation (9) shows that we can solve directly for the required  $V_i$  and that the right hand side is not a function of either h or k.

In solving for the transport in our code, we decompose (L) as the product of an upper matrix multiplying a lower matrix. Equations (7) and (9) can then be solved efficiently by back substitution. It is computationally efficient to do this rather than generate another, smaller matrix for the  $V_{\rm i}$  using a one term approximation and solving this new system. To solve these systems of algebraic equations we have used an assembly language algorithm<sup>25</sup> which has been found to execute on the BRL CDC 7600 about five times faster than the equivalent FORTRAN coding.

#### B. Method II

The above formalism is quite complicated to work with, and so further simplifications are almost invariably made.

For diffusion, we can simplify by taking only one term in the Sonine polynomial expansions. This results in

$$(L^{00,00})$$
  $(c_{100}^{1hk} \dots c_{N00}^{1hk})^{T} = (\delta_{1h} - \delta_{1k}, \dots \delta_{Nh} - \delta_{Nk})^{T} h, k = 1 \dots N, (10)$ 

where the elements of  $(L^{00,00})$  are defined in Appendix C. This can be rearranged to give the Stefan-Maxwell equations, namely,

$$\frac{\partial X_{\mathbf{i}}}{\partial x} = \sum_{j=1}^{N} \frac{X_{\mathbf{i}}X_{\mathbf{j}}}{\mathcal{D}_{\mathbf{i}j}} (V_{\mathbf{j}} - V_{\mathbf{i}}), \quad \mathbf{i}=1 \dots N.$$
 (11)

This set of equations is not independent, and the constraint

$$\begin{array}{ccc}
N \\
\Sigma & Y_i V_i = 0 \\
i = 1 & 1
\end{array}$$
(12)

must be used in place of one of the equations in (11). Then the diffusion velocities can be found by solving a set of N equations in N unknowns. This approach gives zero for the thermal diffusion velocity,  $\psi_{\mathbf{i}}$ .

<sup>&</sup>lt;sup>25</sup>A. C. Hindmarsh, L. J. Sloan, K. W. Fong, and G. H. Rodrique, "DEC/SOL: Solution of Dense Systems of Linear Algebraic Equations", Lawrence Livermore Laboratory, UCID-30137, 1976.

Thermal conductivity cannot be simplified this easily. However, ignoring internal energy, we can obtain the matrix form

$$L^{10,10} (a_{110}^1 \dots a_{N10}^1)^T = (X_1, \dots X_N)^T,$$
 (13)

where  $\lambda_0 = \lambda_{0,\text{tr}} = -4 \sum_{\substack{i=1 \ \text{mixture of monatomic gases}}}^{N} X_i a_{i10}^1.$  This form will be valid for a

To define the heat conductivity for a mixture of polyatomic gases, we adopt Hirshfelder's\* Eucken-type relation, 27,5

$$\lambda_{\min \mathbf{x}}^{\text{poly}} = \lambda_{\min \mathbf{x}}^{\text{mon}} + \sum_{\mathbf{i}=1}^{N} \frac{\lambda_{\mathbf{i}} - \lambda_{\mathbf{i}}^{\text{mon}}}{1 + \sum_{\mathbf{j} \neq \mathbf{i}} \frac{\mathcal{D}_{\mathbf{i}\mathbf{i}}}{\mathcal{D}_{\mathbf{i}\mathbf{j}}^{\text{i}}} \frac{X\mathbf{j}}{X_{\mathbf{i}}^{\text{i}}}$$
(14)

The quantity  $\lambda_0$  in method I is not exactly identical to the usual thermal conductivity  $\lambda_{mix}^{poly}$ , but can be interpreted as the thermal conductivity of a mixture in which the diffusion forces vanish.

If the thermal diffusion coefficients are zero, as they are at this level of approximation, then  $\lambda_0 = \lambda_{mix}^{poly}$ .

#### C. Method III

By making additional assumptions, the Stefan-Maxwell equations (11) can be further simplified. A common assumption is that all but the i<sup>th</sup> species move with the same velocity V. Then we find that

<sup>\*</sup>The detailed analysis of Monchick, et al.,  $^9$  shows that the  $\text{D}_{ij}$  should be  $\text{D}_{i,int,j}$ . From a practical point of view we have taken  $\text{D}_{i,int,j}$  =  $\text{D}_{ij}$ .

<sup>&</sup>lt;sup>26</sup>C. Muckenfuss and C. F. Curtiss, "Thermal Conductivity of Multicomponent Gas Mixtures", J. Chem. Phys. <u>29</u>, 1273-1277 (1958).

<sup>&</sup>lt;sup>27</sup>J. O. Hirshfelder, "Heat Conductivity in Polyatomic, Electronically Excited, or Chemical Reacting Mixtures. III", <u>Sixth International</u> Combustion Symposium, Reinhold Publishing Corporation, NY, 351-366 (1957).

$$\frac{\partial X_{i}}{\partial x} = X_{i} (V - V_{i}) \sum_{j \neq i} \frac{X_{j}}{D_{ij}}.$$
 (15)

Employing (12) we find

$$V = -\frac{Y_{\underline{i}}V_{\underline{i}}}{1-Y_{\underline{i}}}$$
 (16)

which when substituted into (15) yields the formula recommended by Hirshfelder and  $Curtiss^{28}$ 

$$V_{i} = -\frac{(1 - Y_{i})}{X_{i}} \frac{\Sigma X_{j}}{j \neq i} \frac{\partial X_{i}}{D_{ij}}$$
(17)

Unfortunately, the expression in (17) does not in general satisfy equation (12). One technique to satisfy this constraint is due to Boris and Oran.  $^{29}$  They note that if a set of diffusion velocities  $\rm V_i$  satisfy the Stefan-Maxwell equations (11), then so does the set ( $\rm V_i + \rm V_c$ ), where  $\rm V_c$  is some constant. The value of  $\rm V_c$  is chosen such that the constraint (12) is satisfied.\*

The heat conductivity formula employed at this level of approximation is taken from Mason and Saxena's  $^{30}$ ,  $^{5}$  simplification of (14), specifically

<sup>&</sup>lt;sup>28</sup>J. O. Hirshelder and C. F. Curtiss, "Theory of Propagation of Flames Part I: General Equations", <u>Third International Combustion Symposium</u>, Williams and Wilkins Co., Baltimore, 121-127 (1949).

<sup>&</sup>lt;sup>29</sup>E. S. Oran and J. P. Boris, "Detailed Modeling of Combustion Systems", to appear in Progress in Energy and Combustion Science.

<sup>\*</sup>Boris and Oran also discuss higher order approximations to the Stefan-Maxwell equations that will not be discussed here.

 $<sup>^{30}</sup>$ E. A. Mason and S. C. Saxena, "Approximate Formula for the Thermal Conductivity of Gas Mixtures", Phys. Fluids,  $\underline{1}$ , 361-369 (1958).

$$\lambda_{o} = \sum_{i=1}^{N} \frac{\lambda_{i}}{1 + \sum_{j \neq i} \phi_{ij} (X_{j}/X_{i})}$$
(18)

where

$$\phi_{ij} = \frac{1.065}{8^{\frac{1}{2}}} \left(1 + \frac{M_i}{M_j}\right)^{-\frac{1}{2}} \left[1 + \left(\frac{n_i M_j}{n_j M_i}\right)^{\frac{1}{2}} \left(\frac{M_i}{M_j}\right)^{\frac{1}{2}}\right]^2 . \tag{19}$$

#### D. Method IV

Equation (17) or some analogous form has often been used to compute diffusion. However, the usual procedure has been to use (17) only to compute  $V_1, \ldots, V_{N-1}$ . Then  $V_N$  is computed from (12). This is less accurate than the Boris and Oran procedure, expecially for  $V_N$ .

Also, an empirical formula for the thermal conductivity,

$$\lambda_{0} = 0.5 \begin{bmatrix} N \\ \Sigma \\ i=1 \end{bmatrix} + \begin{bmatrix} N \\ \Sigma \\ i=1 \end{bmatrix} -1$$
(20)

is often used. 31,5

Method IV is comprised of these common approximations.

#### E. Method V

In the case of a binary mixture the Stefan-Maxwell equations (11) reduce to Fick's law. Specifically we have,

$$Y_1 V_1 = -D_{12} \frac{\partial Y_1}{\partial x} \quad . \tag{21}$$

<sup>31</sup> J. H. Burgoyne and F. Weinber, "A Method of Analysis of a Plane Combustion Wave", <u>Fourth Symposium on Combustion</u>, Williams and Wilkins Co., Baltimore, 294-302 (1953).

A generalization of (21) can be made, 1 and yields

$$Y_{i}V_{i} = -D_{im} \frac{\partial Y_{i}}{\partial x} , \qquad (22)$$

where

$$D_{im} = \frac{1 - X_{i}}{\sum_{j \neq i} \frac{X_{j}}{D_{ij}}}$$
 (23)

In the Lennard-Jones formalism  $\mathcal{D}_{ij} \propto T^{1.5}/\Omega^{(1,1)*}$ , where  $\Omega^{(1,1)*}$  is approximately proportional to T-0.17.32 Since  $\rho \propto T^{-1}$  it is not unreasonable to assume that  $\rho^2$   $\mathcal{D}_{ij}$  is approximately independent of temperature. Generalizing, it is often assumed that  $(\rho^2 D_{im})$  is constant. Likewise for a monatomic gas  $\lambda \propto T^{0.5}/\Omega^{(2,2)*}$ , where  $\Omega^{(2,2)*} \propto T^{-0.16}$ , 32 and it is not unreasonable to assume that  $(\rho\lambda)$  is approximately independent of temperature. We now outline a procedure that permits an a priori selection of these quantities.

For a given flame we know  $T_u$  and  $Y_{iu}$ , the temperature and the mass fractions of the unburned mixture. We also have a chemical kinetics scheme and a method of computing the specific heats  $c_{pi}$  and specific enthalpies  $h_i$ . Since enthalpy is conserved, i.e.,

$$\begin{pmatrix} N \\ \Sigma \\ i=1 \end{pmatrix}_{B} = \begin{pmatrix} N \\ \Sigma \\ i=1 \end{pmatrix}_{u}, \qquad (24)$$

we can compute the adiabatic flame temperature  $T_B$ . The numerical procedure is to guess a trial burned temperature  $T_t$  and, using an ODE package, find the corresponding equilibrium mass fractions  $Y_{it}$ . We then compute the enthalpy of the burned mixture and compare with the unburned mixture enthalpy.  $T_t$  is iteratively adjusted until the burned and unburned mixture enthalpies agree to within a pre-determined error tolerance. We then accept these values of  $T_t$  and  $Y_{it}$  as  $T_B$  and  $Y_{iB}$ .

<sup>&</sup>lt;sup>32</sup>A. A. Westenberg, "Present Status of Information on Transport Properties Applicable to Combustion Research", Combustion and Flame, 1, 346-358 (1957).

At this level of approximation we would like to use an appropriate constant (or "global")  $c_p$ . So we will assume that  $c_{pi} = c_p = constant$ ,  $i = 1 \dots N$ . Then the relation  $h_i = h_i^{\circ} + \int_{T_0}^{T} c_{pi} dT$  becomes  $h_i = h_i^{\circ} + c_p$  (T -  $T_0$ ) and the mixture enthalpy is given by

$$\sum_{i=1}^{N} Y_{i}h_{i} = \sum_{i=1}^{N} Y_{i}h_{i}^{\circ} + c_{p} (T - T_{o}) .$$
 (25)

Substituting (25) into (24) we find

$$c_{p} = \frac{\sum_{i=1}^{N} h_{i}^{\circ} (Y_{iu} - Y_{iB})}{T_{B} - T_{u}} . \tag{26}$$

As a heuristic rule, we select T = 0.5  $(T_B + T_u)$  and  $Y_i = 0.5$   $(Y_{iB} + Y_{iu})$  and then evaluate  $D_{im}$  and  $\rho\lambda$  by using equations (23) and (20), respectively. Then  $\rho^2 D_{im}$ ,  $i = 1, 2, \dots N-1$ , and  $\rho\lambda$  are evaluated. The diffusion velocity  $V_N$  is found from equation (12).

Others  $^{19-21}$  have employed the concept of constant  $\rho^2 D_{\text{im}},~\rho\lambda$  and  $c_p,$  but the method of evaluation varies from author to author.

#### III. NUMERICAL RESULTS

Table 1 shows a summary of the five methods of computing the transport properties used in this paper. Five H<sub>2</sub>-O<sub>2</sub>-N<sub>2</sub> flames were selected and their initial conditions listed in Table 2. The total pressure is fixed at one atmosphere for all flames. The computed flame speed for each flame as a function of transport method is tabulated in Table 3. (The flame speeds for flame A are not corrected to 291 K, as has been done. If this were done, the value AI for example would be 12.2 cm/s instead of 14.1 cm/s.) The values of the flame speeds span a large range and for a given flame are essentially independent of the transport method. The largest difference between Method I, the most complete formulation of the transport, and any other method is 16%. (Compare Methods I and III, flame D). Note that even Method V gives results that are quite close to the much more complex Method I.

TABLE 1. SUMMARY OF TRANSPORT METHODS

Method	Remarks
I	3 terms of Sonine polynomial expansion (3.N by 3 N matrix); only method that has non-zero thermal diffusion.
II	For diffusion, 1 term of Sonine polynomial expansion (N by N matrix), Eq. (11) and (12). For thermal conductivity, Hirshfelder-Eucken method (N by N matrix), Eq. (13) and (14).
III	Diffusion velocities computed from simplified Stefan-Maxwell relation, Eq. (17). Each is adjusted
	by a common factor, $V_c$ , so as to satisfy $\sum_{i=1}^{\infty} Y_i V_i = 0$ . Thermal conductivity from Mason and Saxena, Eq. (18) and (19).
IV	Diffusion velocities computed from the simplified Stefan-Maxwell relation, Eq. $(17)$ , for N-1 species. $V_N$ is computed from Eq. $(12)$ . Empirical thermal conductivity formula, Eq. $(20)$ .
V	$\rho^2$ $p_{im}$ = constant; $\rho\lambda$ = constant; $c_p$ = constant; constants are determined $\alpha$ priori.

TABLE 2. INITIAL TEMPERATURE AND MOLE FRACTIONS FOR THE FIVE FLAMES STUDIED

Flame	XH2	<u>X<sub>02</sub></u>	<u>XN2</u>	$\underline{T_u}$
A	.1883	.0460	.7657	336
В	. 2000	.1680	.6320	298
С	.5000	.1050	.3950	298
D	.9000	.1000	0	298
Е	.6000	.4000	0	298

TABLE 3. FLAME SPEEDS CALCULATED USING THE FIVE TRANSPORT MODELS

Flame	Ī	II	III	IV	V
A	14.1	14.6	14.9	14.9	16.0
В	98	101	102	103	96
С	292	300	310	308	291
D	378	379	438	402	348
Е	892	922	971	969	847

Reproduction of flame speeds is a necessary but not sufficient condition to judge the relative effectiveness of the transport methods. We must also examine the species and temperature profiles of these flames. As examples we consider two sets of profiles that exhibit differences among the five methods that are as large as any observed. Figures 1 and 2 show the OH profiles for flame D. Figures 3 and 4 show the  $\rm H_2$  profiles for flame C. As can be seen these profiles are very similar. Almost all the other species profiles and all temperature profiles show a greater degree of similarity among the five profiles than the examples given.

In general, our results agree with those reported by Warnatz. <sup>18</sup> The exception is flame A, for which Warnatz reported a flame speed of 10.4 cm/sec, referenced to 291K. Our computed flame speed is about twenty percent higher. Based on our results, we infer that Warnatz's use of a transport method slightly different from any of those reported here should not make that large a difference. We do not know the cause of the discrepancy.

As a check of our code, we computed the flame speed for flame A, using the kinetics and transport parameters of Dixon-Lewis  $^{12}$  and Method I. The resulting flame speed was 9.2 cm/sec, referenced to 291K. This agrees with the computed result reported by Dixon-Lewis and we conclude that our code is functioning properly.

We are comparing the model results produced as we vary the transport algorithm and not comparing the model result with experiment. Thus, the fact that the use of Warnatz' parameters produces a slightly inaccurate flame speed for flame A is of no concern.

#### IV. DISCUSSION

The numerical results shown in Table 3 demonstrate that reliable results can be obtained for the  $H_2$ - $O_2$ - $N_2$  system even for the case of our a priori determined constant transport method. Note that we cannot infer that transport is unimportant! The computed profiles and flame speeds can be sensitive to the choice of transport parameters selected. For the relative tests of the transport methods here, we have employed the same set of species viscosities, thermal conductivities and binary diffusion coefficients in all cases. We have demonstrated that the method used to generate the multicomponent, polyatomic transport coefficients is not critical for the  $H_2$ - $O_2$ - $N_2$  flame. And since this flame is reasonably complex we infer that this result has a high probability of being valid for other flames.

Indeed, we conclude that gross errors detected in comparing the results of different models are more likely to be traceable to differences in input data rather than to the method of approximating multicomponent polyatomic transport properties.

We cannot completely explain the surprising agreement among the

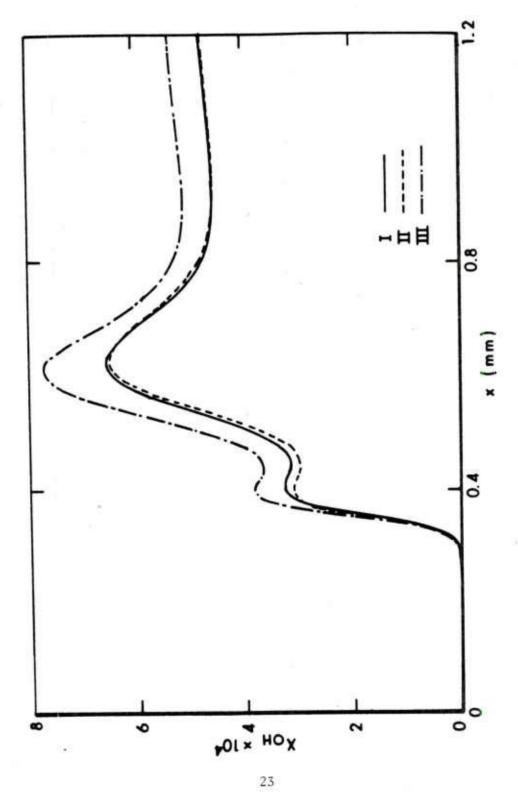


Figure 1. The OH Profile for Flame D.

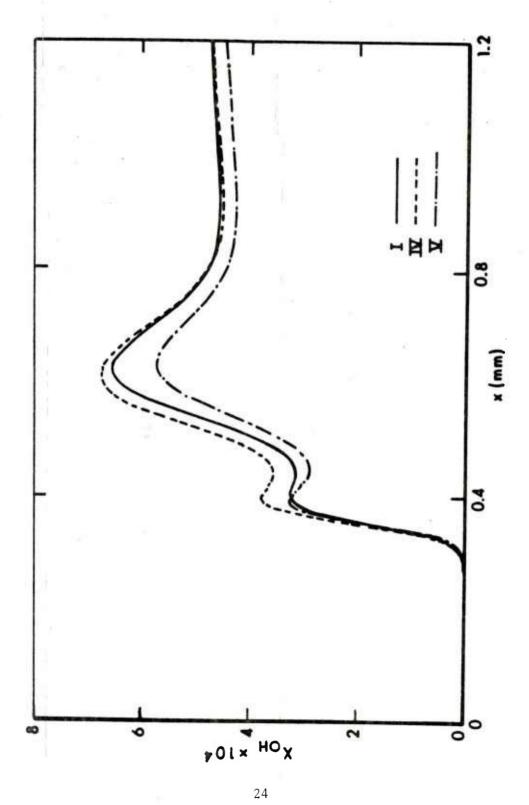
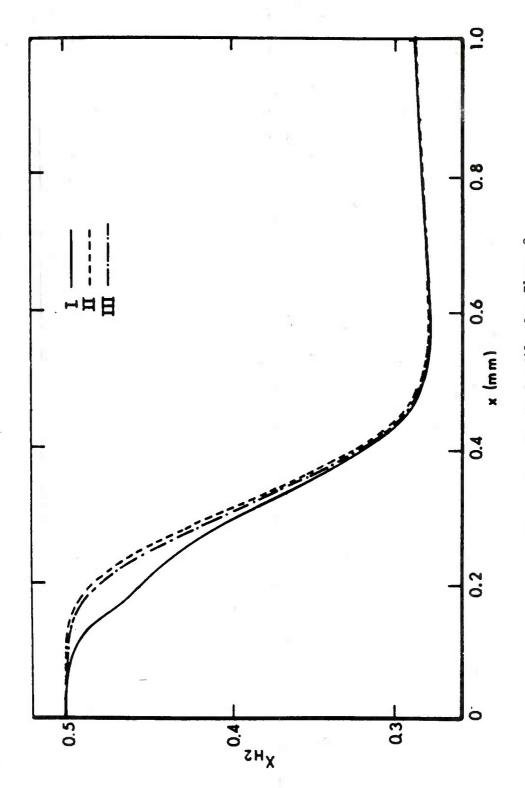
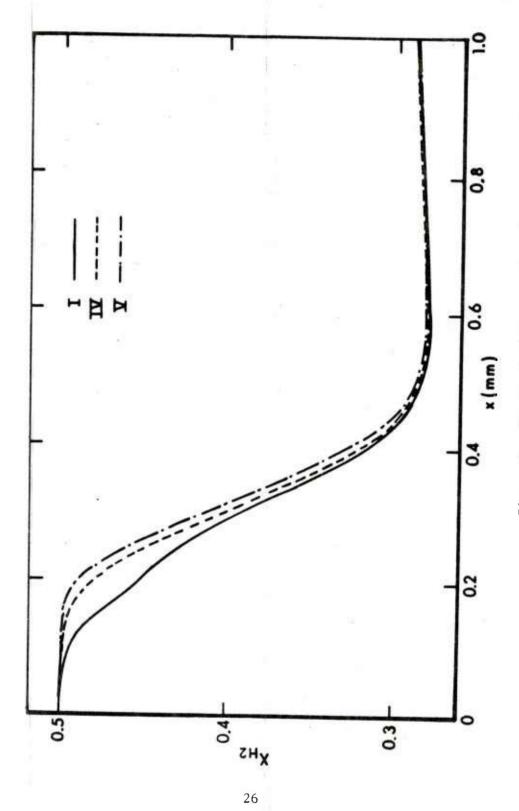


Figure 2. The OH Profile for Flame D.





various methods. In this section we will show that our results are consistent with the few previous studies of transport algorithms. We will also discuss some additional numerical results that give some indication of the processes involved.

 ${\tt Warnatz}^{14}$  essentially compared Methods II and III for an ozone flame and found the differences negligible. However, it was not clear that his observations could be generalized to more complex flames.

In another paper  $^{18}$  Warnatz included thermal diffusion in a simulation of an  $\rm H_2\text{-}O_2\text{-}N_2$  flame. He used essentially Method IV together with a simple binary formula for thermal diffusion valid only for heavy isotopes. He found that the effect of thermal diffusion so defined was to lower the flame speed in a rich flame by about 5%. Species and temperature profiles were only slightly changed. He did not discuss the accuracy of this approximation for a mixture.

As noted earlier, Dixon-Lewis  $^{24}$  considered the effect of thermal diffusion. However, he assumed a particular mass flow and simplified chemistry. He found that the thermal diffusion flux of  $\rm H_2$  was quite large and inferred that effects due to thermal diffusion would be important when considering hydrogen atom diffusion in flame systems. This inference is contrary to our findings. Our results also show that, for H and  $\rm H_2$ , the thermal diffusion velocity  $\rm W_i$  can be quite large compared to the species diffusion velocity  $\rm V_i$ . However, we find that these differences cause only small changes in both the flame speeds and the profiles. This finding supports that of Dixon-Lewis  $\rm ^{12}$  who in a recent paper reported that the inclusion of thermal diffusion for near stoichiometric  $\rm H_2$ -air flames lowers the burning velocity by 5 to 6%.

In an attempt to gain additional insight, we have written an auxilary code to directly compare the transport properties. The input required for this code are the values of the temperature, the species concentrations, and the temperature and species gradients. Then the thermal conductivity  $\lambda_{0}$  and the diffusion velocities  $V_{1}$  are computed using the subroutines written for Methods I through IV, and comparisons among the values for  $\lambda_{0}$  and  $V_{1}$  are made. By doing this we avoid the complicated interplay between transport and chemistry that occurs in flames.

The auxiliary code was executed using several hundred sets of input values that were typical of those observed in the flames reported above. These input values were divided into four groups for analysis. Group 1 consisted of small species and temperature gradients, Group 2 of large species and temperature gradients, Group 3 of large species gradients and a zero temperature gradient, and Group 4 of small species gradients and large temperature gradients. By a large gradient we mean a value typical of a flame front.

The values of thermal conductivity computed with the auxiliary code showed little variation, regardless of the input group or approximation

method used. Specifically, the differences between Methods I and II, I and III, and I and IV averaged 2, 3 and 5%, respectively. In general, the thermal conductivities of the individual species are not this well known either theoretically or experimentally. So despite the widely different levels of complexity, the four methods produced equivalent values for  $\lambda_0$ .

The results of the comparisons for diffusion velocities are more difficult to summarize. Differences varied from less than 1% up to several hundred percent, depending on the particular input values and the particular species considered. Differences of 30 to 40% were common and in general were larger for the major species than for the minor species.

We could not establish why there was a high degree of similarity in the flame speeds and profiles even though these were large differences in the V<sub>i</sub> in the auxiliary code. We speculate that part of the reason for this is due to the constraint  $\Sigma$  Y<sub>i</sub>V<sub>i</sub> = 0, which is satisfied by all of our methods. Another constraint on the diffusion velocities in the flame code is the fixed chemistry employed. How the non-linear feedback between the chemistry and the transport affects the similarity in the flame speeds and profiles is unknown.

Nevertheless, some interesting conclusions can be drawn from these comparisons. For instance, it is often assumed that thermal diffusion is negligible. This assumption corresponds to that made in Group 3. (If the temperature gradient is zero, the thermal diffusion velocities  $\boldsymbol{W}_{i}$  will also be zero).

For this group, we find that the values of the diffusion velocities computed by Methods I and II agree to about 1%. In contrast, the values of the diffusion velocities computed by Methods III and IV differ from those computed by Method I by much more (typical differences are around 40%). This comparison implies that Method II (i.e., the Stefan-Maxwell equations) is much more accurate in determining the values for the diffusion velocities than the non-matrix methods. Note that this conclusion is valid only for the case of zero temperature gradient.

For the other three groups of input to our auxiliary code, we find that the diffusion velocities computed by Method III are usually in better agreement with those computed by Method I than those computed by Method II! This situation can occur because in Method III the errors in ignoring thermal diffusion and in approximating the molecular diffusion velocities are generally of opposite sign. We conclude that it is a waste of effort to use a matrix method (such as the Stefan-Maxwell equations) to compute diffusion velocities unless thermal diffusion is also considered.

Method III is generally more accurate than Method IV. Method IV can be extremely inaccurate in computing the diffusion velocity for the

Nth species. In the cases considered we have found that the values computed by Method IV for  $N_2$  differ, on the average, more than 100% from the values found by Method I. This is due to the procedure used to obtain the diffusion velocity for the Nth species. This procedure tends to associate cumulative errors caused by neglect of the constraint, Eq. (12), with the Nth species, here  $N_2$ . We have found that Method III (the Boris and Oran procedure) is at least as accurate and in some cases substantially more accurate than the traditional Method IV for computing the  $V_1$ . Furthermore the Boris and Oran procedure involves very little additional computational effort.

#### V. A NEW TRANSPORT METHOD

For flames more complicated than  $H_2\text{-}O_2\text{-}N_2$  we require a transport algorithm that is computationally efficient and relatively precise. The most exact procedure considered, Method I, can become prohibitively expensive for a large number of species. Method V is computationally efficient, but we feel caution is necessary in using such a simplified model. There does not seem to be a great deal to choose from among Methods II, III, and IV and so we have assembled a new method, Method VI.

As with Methods II-V we require expressions for  $\lambda$  and for the  $V_i (= V_i + W_i)$ . For the thermal conductivity we use the simplest formula (20), since the exact choice does not appear to be important. For the molecular diffusion velocities  $V_i$  we use the expression in equation (17).

For problems with light species and steep temperature gradients, the neglect of thermal diffusion is often as important as the differences between the computational methods. So below we generate a technique that approximates the thermal diffusion contribution to the diffusion velocity,  $W_i$ . We shall first derive an expression for  $W_i$  of a binary mixture and then generalize the results.

For a binary mixture equation (2a) can be written

$$V_{1} = -\frac{(1-Y_{1})}{X_{1}X_{2}} \mathcal{D}_{12} \frac{\partial X_{1}}{\partial x} - \frac{D_{1}^{T}}{\rho Y_{1}} \frac{\partial LnT}{\partial x}$$

$$(27)$$

from which we identify

$$\omega_1 = -\frac{D_1^T}{\rho Y_1} \frac{\partial \ln T}{\partial x} . \tag{28}$$

Since, from Eq. (17),

$$V_{1} = -\frac{(1-Y_{1})}{X_{1}X_{2}} v_{12} \frac{\partial X_{1}}{\partial x}$$
 (29)

and since the thermal diffusion ratio is defined by reference 6

$$k_{12} = \frac{X_1 X_2}{\rho Y_1 Y_2} \frac{D_1^T}{D_{12}} , \qquad (30)$$

we can write, after some algebra,

$$W_1 = k_{12} V_1 \frac{\partial}{\partial x} (\ln T) / \frac{\partial X_1}{\partial x} . \tag{31}$$

Theoretical expressions for  $k_{12}$  have been derived and even in the first approximation the expressions are quite complicated.<sup>6</sup> For the special case of heavy isotopes, however, the first approximation simplifies to<sup>6</sup>

$$k_{12} = \frac{15(2A^* + 5)(6C^* - 5)(M_1 - M_2)}{2A^*(16A^* - 12B^* + 55)(M_1 + M_2)} X_1 X_2 .$$
 (32)

Fortunately Eq. (32) reproduces  $H_2$ - $N_2$  thermal diffusion ratios to within 30%, and so we use it as a simple but reasonable approximation for  $k_{12}$ . Equation (31) can now be evaluated (in the code).

Generalizing Eq. (31) we define

$$W_{i} = k_{im} V_{i} \frac{\partial}{\partial x} (\ln T) / \frac{\partial X_{i}}{\partial x} . \tag{33}$$

If an expression for  $k_{\rm im}$  can be obtained, then  $W_{\rm i}$  of Eq. (33) can be evaluated. Chapman and Cowling<sup>33</sup> have derived an approximation for  $k_{\rm im}$ ,

<sup>33</sup>S. Chapman and T.G. Cowling, The Mathematical Theory of Non-Uniform Gases, Third Edition, Cambridge University Press (1970).

specifically

$$k = \sum_{j=1}^{N} k_{ij}$$

$$i \neq j$$
(34)

where  $k_{ij}$  is given by an expression analogous to Eq. (32).

From Eq. (32) we can see that the influence of  $W_i$  will be the greater the larger the mass differences. Normally the thermal diffusion ratio does not exceed 0.1 and for the  $H_2-O_2-N_2$  system, we have computed  $W_i$  only for the species H and  $H_2$ . The resulting diffusion velocities  $V_i = V_i + W_i$  do not satisfy the constraint  $\sum_{i=1}^{L} Y_i V_i = 0$ . We use the Boris and Oran procedure discussed in Section II to obtain this condition.

Computationally, the quantity  $15(2A^* + 5)/(2A^*(16A^* - 12B^* + 55))$  can be fitted very accurately by a function of the form: a exp (c/T\*). The quantity (6C\* - 5) varies over the range zero to one and could not be fitted accurately by a simple expression. The fit for C\* given in Appendix D is used instead.

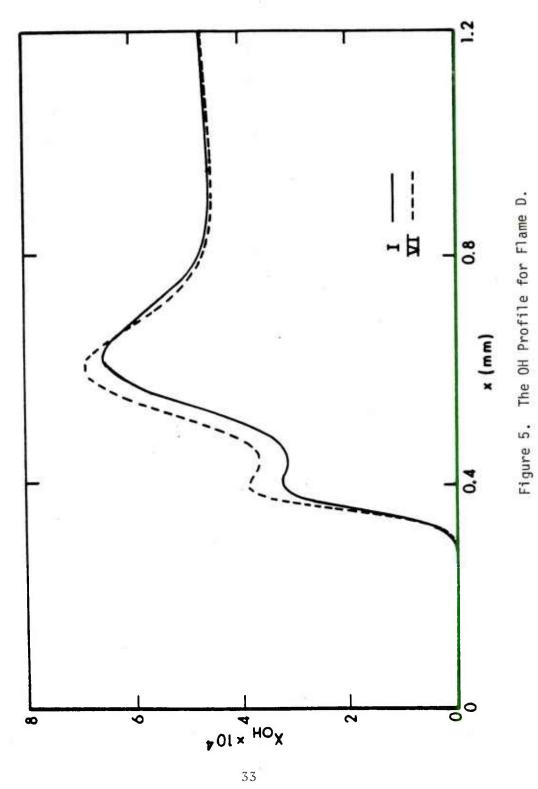
This new method for approximating multispecies transport has been exercised in our test flames. Table 4 compares the flame speeds for Methods I and VI. The results are so close that we infer that some of the errors made in the approximations involved in Method VI are cancelling.

Figure 5 compares the OH profiles for flame D and figure 6 compares the  $\rm H_2$  profiles for flame C. In general, for the minor species, the accuracy of Method VI is comparable to Methods II or III. However, in almost every profile involving a major species, the accuracy was improved.

#### VI. ADDENDUM

A few additional comparisons have recently been made. In the spirit of approximation exemplified in the discussion of Method V, the further assumption is sometimes made that all the Lewis numbers (Le<sub>i</sub> =  $\lambda/c_p \rho D_{im}$ ) are equal to unity. Given values for  $\rho\lambda$  and  $c_p$ , this assumption defines the diffusion coefficients and removes the requirement of supplying independent information for them. We tested how well this additional level of simplification fared by applying it in the code using flame C. The computed flame speed was about 40% lower than for Method I. While the major species profiles were still reasonably close to those of Method I, they were noticeably less accurate than Method V. The minor species profiles showed large differences: the peak concentrations of 0, HO<sub>2</sub>, and H<sub>2</sub>O<sub>2</sub> were lower than those of Method I by about a factor of two.

In an effort to substantiate our earlier inference concerning the transfer of these results to other (hydrocarbon) flames we performed some checks on the stoichiometric methane-air flame. For this flame we used the input parameters listed by Tsatsaronis,  $^{13}$  the kinetics scheme was used as listed, and we made no attempt to critically evaluate it. The flame speeds computed for Methods I, V, and VI are in the ratio 1.00 to 0.88 to 0.94, respectively. The profiles for Method VI are more accurate than those produced by Method V. These results follow the same trend as in the  $\rm H_2-\rm O_2-\rm N_2$  flames reported above.



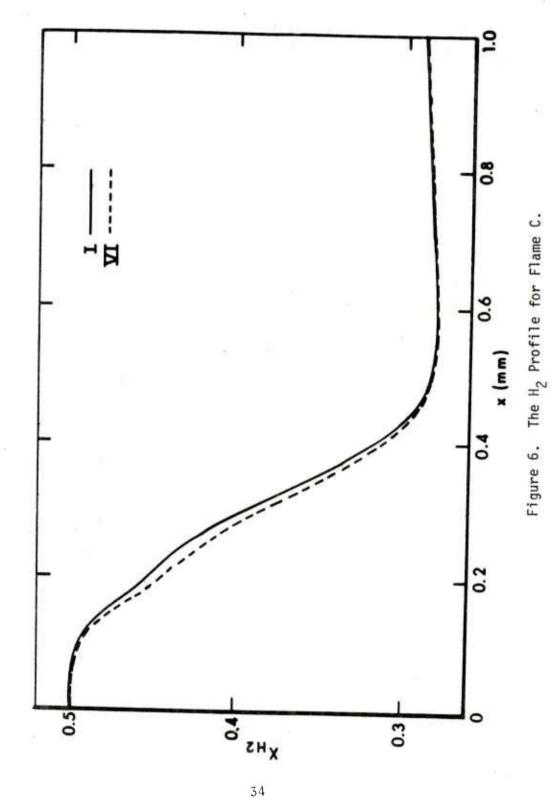


TABLE 4. FLAME SPEEDS CALCULATED USING TWO TRANSPORT MODELS

Flame	<u>I</u>	VI
A	14.1	14.0
В	98	97
С	292	292
D	378	402
E	892	894

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## APPENDIX A. THE FLAME EQUATIONS

We are interested in the equations that describe a one-dimensional, laminar, premixed flame that propagates in an unbounded ideal gas. The effects of radiation, viscosity, and body forces are ignored. Since the burning velocity is small compared with the local speed of sound, the pressure is taken to be constant. The resulting equations (see for example reference 2 of text) are:

Overall Continity:

$$\frac{\partial \rho}{\partial t} + \frac{\partial (\rho u)}{\partial x} = 0 \qquad . \tag{A-1}$$

Continuity of Species:

$$\rho \frac{\partial Y_{i}}{\partial t} + \rho u \frac{\partial Y_{i}}{\partial x} = -\frac{\partial}{\partial x} (\rho Y_{i} V_{i}) + R_{i} M_{i}, i = 1,...N$$
 (A-2)

and Conservation of Energy:

$$\rho c_{\rho} \frac{\partial T}{\partial t} + \rho u c_{\rho} \frac{\partial T}{\partial x} = -\frac{\partial q}{\partial x} + \sum_{i=1}^{N} h_{i} \left[ \frac{\partial (\rho Y_{i} V_{i})}{\partial x} - R_{i} M_{i} \right]. \tag{A-3}$$

The boundary conditions are the following (t > 0). For  $x = -\infty$ ;

$$T = T_u \text{ and } Y_i = Y_{iu} (i=1,...N)$$
, (A-4)

and for  $x = \infty$ ;

$$\frac{\partial T}{\partial x} = \frac{\partial Y_i}{\partial x} = 0 \quad (i=1,...N) \quad . \tag{A-5}$$

The transport properties that we are interested in are the diffusion velocities  $\boldsymbol{V}_{\underline{i}}$  and the heat flux q.

# APPENDIX B. H<sub>2</sub>-O<sub>2</sub>-N<sub>2</sub> INPUT PARAMETERS

The required input data for the  $H_2$ - $O_2$ - $N_2$  flames are for the most part taken from Warnatz (see reference 18 of text).

The kinetic scheme consists of thirty reactions and has been taken in toto from Warnatz' Table 3, which for the most part was taken from the Leeds review. Our interest here is a study of the effects of using different transport algorithms, and not a critical evaluation of the kinetics. So we have uncritically used Warnatz' mechanism. This mechanism is in reasonable agreement with experimental data.

The enthalpies and heat capacities are evaluated using the sixth order polynomial fits of Gordon and McBride (see reference 4 of text). These reproduce the JANNAF (see reference 3 of text) values to within a few parts per thousand over the temperature range 300K-3000K.

The transport parameters are given in Table B-2. These are from Warnatz except for  $\xi_{ii}^{\infty}$  for OH, which is from Dixon-Lewis (see reference 12 of text). The values for  $\sigma$  and  $\varepsilon/k$  are obtained from viscosity measurements.

The manipulation of these parameters is discussed in Appendix D.

B1D. L. Baulch, D. D. Drysdale, D. G. Horne, and A. C. Lloyd, <u>Evaluated</u>
<u>Kinetic Data for High Temperature Reactions</u>, Vol. 1, Butterworths,
<u>London 1972</u>.

TABLE B-1. REACTIONS IN THE  $\rm H_2-\rm O_2-\rm N_2$  SYSTEM

NO	REACTION	A*	В	С
1	$OH + H_2 \rightarrow H_2O + H$	2.2E13**	0	- 2590
2	$H + H_2O \rightarrow OH + H_2$	9.3E13	0	-10250
3	$H + O_2 \rightarrow OH + O$	2.2E14	0	- 8450
4	$0 + 0H \rightarrow H + 0_2$	1.0E13	0	0
5	0 + H <sub>2</sub> → 0H + H	1.8E10	1	- 4480
6	$H + OH \rightarrow O + H_2$	8.3E09	1	- 3500
7	$OH + OH \rightarrow H_2O + O$	6.3E12	0	- 550
8	$0 + H_2O \rightarrow OH + OH$	6.8E13	0	- 9240
9	$H + H + M' \rightarrow H_2 + M'$	9.0E17	-1	0
10	$H + OH + M' \rightarrow H_2O + M'$	2.2E22	-2	0
11	$H + O_2 + M' \rightarrow HO_2 + M'$	5.0E15	0	500
12	$H + HO_2 \rightarrow OH + OH$	2.5E14	0	- 950
13	$H + HO_2 \rightarrow H_2 + O_2$	2.5E13	0	- 350
14	$H + HO_2 \rightarrow H_2O + O$	1.5E13	0	- 500
15	$OH + HO_2 \rightarrow H_2O + O_2$	5.0E13	0	- 500
16	$0 + HO_2 \rightarrow OH + O_2$	5.0E12	0	- 500
17	$OH + OH + M \rightarrow H_2O_2 + M$	9.1E14	0	2550
18	$H + H_2O_2 \rightarrow H_2O + OH$	3.2E14	0	- 4500
19	$HO_2 + HO_2 \rightarrow H_2O_2 + O_2$	8.5E12	0	- 500
20	$H_2 + M' \rightarrow H + H + M'$	8.8E14	0	-48300
21	$0 + 0 + M \rightarrow 0_2 + M$	7.0E13	0	900
22	$HO_2 + M' \rightarrow H + O_2 + M'$	7.0E15	0	-23000
23	$OH + OH \rightarrow HO_2 + H$	1.2E13	0	-20200

TABLE B-1. REACTIONS IN THE H<sub>2</sub>-O<sub>2</sub>-N<sub>2</sub> SYSTEM (Cont'd)

NO	REACTION	<u>A*</u>	<u>B</u>	<u>C</u>
24	$HO_2 + H_2 \rightarrow H_2O_2 + H$	7.3E11	0	- 9400
25	$H + H_2O_2 \rightarrow H_2 + HO_2$	1.7E12	0	- 1900
26	$H_2O_2 + M \rightarrow OH + OH + M$	1.2E17	0	-22900
27	$0 + H_2O_2 \rightarrow OH + HO_2$	2.8E13	0	- 3200
28	$0 + H_2O_2 + H_2O + O_2$	2.8E13	0	- 3200
29	$OH + H_2O_2 \rightarrow H_2O + HO_2$	1.0E13	0	- 910
30	$HO_2 + H_2O \rightarrow H_2O_2 + OH$	2.8E13	0	-16500

[M] = total concentration

$$[M'] = 6.0 [H_20] + 1.0 [H_2] + 0.4 [0_2] + 0.4 [N_2]$$

<sup>\*</sup>A is in units of  $cm^3/mole$ -sec or  $cm^6/mole^2$ -sec,  $k = AT^B \exp(C/T)$ .

<sup>\*\*</sup> $2.2E13 = 2.2 \times 10^{13}$ .

TABLE B-2. MOLECULAR PARAMETERS USED FOR THE DETERMINATION OF TRANSPORT PROPERTIES

	$\frac{\varepsilon}{k}$ [K]	μ[Deby	re] α[Å <sup>3</sup>	<u>ξ<sup>∞</sup>ii</u>
2.	75 80	0	0	
3.4	16 107	0	1.60	14.4
2.0	)5 145	0	0	
2.9	92 38	0	0.79	280
2.	75 80	0	0	4.5
2.6	50 572	1.844	0	4.0
3.0	52 97.5	0	0	15.7
	$\frac{\sigma[A]}{2.5}$	2.75       80         3.46       107         2.05       145         2.92       38         2.75       80         2.60       572	$\sigma[A]$ $\overline{k}$ $[K]$ $\mu[Deby]$ 2.75     80     0       3.46     107     0       2.05     145     0       2.92     38     0       2.75     80     0       2.60     572     1.844	2.75       80       0       0         3.46       107       0       1.60         2.05       145       0       0         2.92       38       0       0.79         2.75       80       0       0         2.60       572       1.844       0

 $HO_2$ ,  $H_2O_2$  like  $O_2$ 

#### APPENDIX C. DEFINITION OF THE MATRIX L

The matrix L can be partitioned into nine N by N matrices

$$L = \begin{pmatrix} L^{00,00} & L^{00,10} & L^{00,01} \\ L^{10,00} & L^{10,10} & L^{10,01} \\ L^{01,00} & L^{01,10} & L^{01,01} \end{pmatrix}$$
(C-1)

where

$$L_{ii}^{00,00} = 0,$$
 (C-2)

$$L_{ij}^{00,00} = \frac{16}{25} \frac{T}{P} \left[ \frac{X_{i}X_{j}}{D_{ij}} + \sum_{k \neq i} \frac{M_{j}}{M_{i}} \frac{X_{k}X_{j}}{D_{ik}} \right], i \neq j,$$
 (C-3)

$$L_{ij}^{00,10} = -\frac{8T}{5P} \frac{M_{i}(1.2 C_{ij}^{*} - 1)X_{i}X_{j}}{(M_{i} + M_{j}) D_{ij}}, i \neq j, \qquad (C-4)$$

$$L_{ii}^{00,10} = -\sum_{j\neq i} L_{ji}^{00,10}$$
, (C-5)

$$L_{ij}^{10,00} = L_{ji}^{00,10}$$
, (C-6)

$$L_{ij}^{01,00} = L_{ij}^{00,01} = 0$$
 (C-7)

$$L_{ii}^{10,10} = -\frac{16 M_{i} X_{i}^{2}}{15 R \eta_{i}} \left(1 + \frac{10 C_{i,rot}}{3\pi R \xi_{ii}}\right) - \frac{16T}{25P} \sum_{k \neq i} \left\{ \frac{X_{i} X_{k}}{(M_{i} + M_{k})^{2} \mathcal{D}_{ik}} X_{ik} \right\}$$

$$\left[\frac{15}{2} M_{i}^{2} + \frac{25}{4} M_{k}^{2} - 3M_{k}^{2} B_{ik}^{*} + 4M_{i}M_{k}A_{ik}^{*} \left(1 + \frac{5}{3\pi}\right) \right] \left\{\frac{C_{i, rot}}{R \xi_{ik}} + \frac{C_{k, rot}}{R \xi_{ik}}\right\} \right] \right\}, \qquad (C-8)$$

$$L_{ij}^{10,10} = \frac{16T}{25P} \frac{M_{i}M_{j} X_{i}X_{j}}{(M_{i} + M_{j})^{2} \mathcal{D}_{ij}}$$

$$\left\{ \frac{55}{4} - 3 B_{ij}^{*} - 4 A_{ij}^{*} \left[ 1 + \frac{5}{3\pi} \left( \frac{C_{i, rot}}{R \xi_{ij}} + \frac{C_{j, rot}}{R \xi_{ji}} \right) \right] \right\}, \quad i \neq j$$
(C-9)

$$L_{ii}^{10,01} = \frac{16M_{i} X_{i}^{2} C_{i, rot}}{3\pi R \eta_{i}^{C} C_{i, int}^{\xi} ii} + \frac{32 T}{5\pi P^{C}_{i, int}} \sum_{k=i}^{\Sigma} \frac{M_{i} A^{*} ik X_{i} X_{k} C_{i, rot}}{(M_{i} + M_{k}) D_{ik}^{\xi} \xi_{ik}}, \qquad (C-10)$$

$$L_{ij}^{10,01} = \frac{32 \text{ T Mj A}^{*} \text{ij X}_{i} \text{ Xj Cj, rot}}{5 \text{ p } \pi \text{ C}_{j, int} (M_{i} + M_{j}) \mathcal{D}_{ji} \xi_{ji}} . \tag{C-11}$$

$$L_{ij}^{01,10} = L_{ji}^{10,01}$$
, (C-12)

$$L_{ij}^{01,10} = 0, i \neq j$$
 (C-13)

and

$$L_{ii}^{01,01} = -\frac{8M_{i}X_{i}^{2}C_{i}, \text{ rot}}{\pi \eta_{i} \xi_{ii}C_{i}^{2}, \text{ int}} - \frac{4RT}{p C_{i}, \text{ int}} \left\{ \sum_{k} \frac{X_{i}X_{k}}{D_{i}, \text{ int}, k} + \sum_{k \neq i} \frac{12 M_{i} A^{*}ik X_{i}Xk C_{i}, \text{ rot}}{5\pi M_{k} D_{ik}C_{i}, \text{ int}} \xi_{ik} \right\}.$$
(C-14)

When solving equations (7) and (6) for the thermal conductivity,  $\lambda_{O}$  will turn out to have the units cm<sup>2</sup>-atm-s<sup>-1</sup>-K<sup>-1</sup>. To convert to the more usual units of cal-cm<sup>-1</sup>-s<sup>-1</sup>-K<sup>-1</sup>, we multiply by R/R<sub>a</sub> = 1.9872/82.05.

#### APPENDIX D. MANIPULATION OF TRANSPORT DATA

The quantities required to compute the elements of the matrix L used in Method I can be calculated from the transport parameters (Table B-2) and the heat capacities (see reference 4 of text). We shall discuss the procedures in this appendix.

The viscosity  $\eta_{\bf i}$  and the binary diffusion coefficients  ${\mathfrak D}_{\bf ij}$  can be obtained from Lennard-Jones (non-polar) or Stockmayer (polar) parameters  $\sigma_k$  and  $\varepsilon_k/k$ . For polar molecules (here only H2O) we also need the dipole moment  $\mu_{\bf i}$ . For the binary diffusion coefficient of a polar and a non-polar species, we also need the polarizibility  $\alpha_{\bf i}$  of the non-polar species. Then  $\eta_{\bf i}$  and  ${\mathfrak D}_{\bf ij}$  are calculated using tabulated values of the collision integrals  $^1,^2$  (see also reference 6 of text).

The quantities  $A_{ij}^*$ ,  $B_{ij}^*$ , and  $C_{ij}^*$  do not have exactly their standard meanings (see reference 9 of text). However, they can be closely approximated by the usual quotients of collision integrals. For Lennard-Jones parameters, these are tabulated in reference 6 of text. For simplicity, we will assume that at most one of the species is polar (in our case H<sub>2</sub>O). Since a polar molecule interacting with a non-polar molecule can be represented by a Lennard-Jones potential, all the quantities  $A_{ij}^*$ ,  $B_{ij}^*$ , and  $C_{ij}^*$  can be cast into the Lennard-Jones formalism. They are functions only of  $T_{ij}^* = T/(\epsilon_{ij}/k)$ , where  $\epsilon_{ij}$  is obtained from  $\epsilon_{i}$  and  $\epsilon_{j}$  by standard combining rules (see also reference 6 of text).

The collision numbers  $\xi_{ij}$  for rotational relaxation of species i on colliding with species j are difficult to obtain, particularly if  $i \neq j$ . Fortunately, these values are not critical. For simplicity, we will assume that  $\xi_{ij} = \xi_{ii}$ . Parker<sup>3</sup> has calculated values for  $\xi_{ii}$  for homonuclear diatomic molecules, as well as the temperature relation

$$\xi_{ii} = \xi_{ii}^{\infty} \left[ 1 + \frac{\pi^{3/2}}{2(T_{i}^{*})^{\frac{1}{2}}} + \left(\frac{\pi^{2}}{4} + \pi\right) \frac{1}{T_{i}^{*}} \right]^{-1}$$
 (D-1)

We use his values for  $O_2$  and  $N_2$ . For other types of molecules, we must look for experimental values. In this paper, we take these other  $\xi_{ii}$ 's to be constant. The values for  $\xi_{ii}$  are taken from Warnatz (see reference 14 of text) except the value of  $\xi_{ii}$  for OH (see reference 12 of text).

 $<sup>^{</sup>D1}$ R. C. Reid and T. K. Sherwood, <u>The Properties of Gases and Liquids</u>, 2nd Edition, McGraw-Hill, NY, (1966).

D2L. Monchick and E. A. Mason, "Transport Properties of Polar Gases", J. Chem. Phys., 33, 1676-1697 (1961).

The quantities  $\mathcal{D}_{i,int,j}$  refer to the diffusion of internal energy, which is approximated by  $\mathcal{D}_{ij}$ . More accurate values are very difficult to calculate, and there is no known way of determining them experimentally (see reference 9 of text).

To obtain the  $C_{i,rot}$  and  $C_{i,int}$ , we need to properly partition  $C_{i,v}$ , the heat capacity at constant volume.  $C_{i,v}$  can be calculated from the Gordon and McBride polynominal fits (see reference 4 of text). It can be partitioned as

$$C_{i,v} = C_{i,tr} + C_{i,int},$$
 (D-2)

where  $C_{i,tr} = 1.5$  R. The internal energy can be further partitioned into rotational and vibrational energy.  $C_{i,rot} = 0$  for a monatomic molecule,  $C_{i,rot} = R$  for a linear molecule, and  $C_{i,rot} = 1.5$  R for a polyatomic molecule.

For Method I, we do not need to directly compute the separate species thermal conductivities  $\lambda_i$ . These values are required for the other methods, so we will discuss them here.

For monatomic gases,

$$\lambda_{i}^{\text{mon}} = \frac{15}{4} \frac{R}{M_{i}} \eta_{i}, \qquad (D-3)$$

where a hard sphere model has been assumed! (see also reference 6 of text).

For polyatomic gases, there are many procedures. We will follow the analysis of Mason and Monchick, 1,4 and write

$$\frac{\lambda_{\underline{i}}M_{\underline{i}}}{\eta_{\underline{i}}} = f_{tr} C_{\underline{i},tr} + f_{int} C_{\underline{i},int}$$
 (D-4)

where

 $<sup>^{</sup>D3}$ J. G. Parker, "Rotational and Vibrational Relaxation in Diatomic Gases", Phys. Fluids,  $\underline{2}$ , 449-462 (1959).

D4 E. A. Mason and L. Monchick, "Heat Conductivity of Polyatomic and Polar Gases", J. Chem. Phys., 36, 1622-1639 (1962).

$$f_{tr} = \frac{5}{2} \left[ 1 - \frac{10}{3\pi} \left( 1 - \frac{2}{5} \frac{M_{i} \rho \mathcal{D}_{i,int,i}}{\eta_{i}} \right) \left( \frac{C_{i,rot}}{R \xi_{ii}(rot)} + \frac{C_{i,vib}}{R \xi_{ii}(vib)} \right) \right], \qquad (D-5)$$

$$f_{int} = \frac{M_{i} \rho \mathcal{D}_{i,int,i}}{\eta_{i}} \left[ 1 + \frac{5}{\pi} \left( 1 - \frac{2}{5} \frac{M_{i} \rho \mathcal{D}_{i,int,i}}{\eta_{i}} \right) \left( \frac{C_{i,rot}}{C_{i,int}} \xi_{ii}(rot) \right) + \frac{C_{i,vib}}{C_{i,int}} \xi_{ii}(vib) \right]. \tag{D-6}$$

Normally,  $\xi_{ii}(vib) >> \xi_{ii}(rot)$ , so we will ignore the vibrational term. We then refer to  $\xi_{ii}(rot)$  just as  $\xi_{ii}$ . As usual, we approximate  $\mathcal{D}_{i,int,i}$  by the self diffusion coefficient  $\mathcal{D}_{ii}$ .

Using either Lennard-Jones or Stockmayer collision integrals,

$$\frac{M_{i} \rho D_{ii}}{\eta_{i}} = 1.1999 \text{ A}^{*} \sim 1.32.$$
 (D-7)

Equation (D-4) then simplifies to

$$\frac{\lambda_{i}M_{i}}{\eta_{i}} = 1.32 C_{i,v} + 1.77R - .886 \frac{C_{i,rot}}{\xi_{ii}}$$
 (D-8)

As before, the exact value of  $\xi_{ij}$  is not critical in the computation.

For actual use in the code, a fit to the  $\eta_{\textrm{i}}$ ,  $\lambda_{\textrm{i}}$ , and  $\mathcal{D}_{\textrm{ij}}$  is made of the form  $aT^b$  over an appropriate temperature range, using the logarithmic method with proper transformation of weights.  $^5$  The resulting fits are accurate within two percent.

D5<sub>R.</sub> J. Cvetanovic and D. L. Singleton, Internat. J. Chem. Kinet., 9, 481-488, 1977; R. J. Cvetanovic and D. L. Singleton, Internat. J. Chem. Kinet., 1007-1009, 1977.

The quantities A\*, B\*, and C\* are fit over a range  $1.0 \le T^* \le 400$ . This covers the range likely to occur in a flame. If the fit is extended to values of  $T^* \le 1$ , the accuracy suffers. A\* can be fit very accurately by a function of the form:  $a(T^*)b$ . To fit B\* and C\* accurately, we need to use the functional form: a exp  $(c/T^*)$  (see Table D-1).

Given the above information, we have developed software to write the actual transport subroutine used in the code.

TABLE D-1. FITS TO THE FUNCTIONS  $A^*, B^*, C^*$ (a (T\*)b or a exp (c/T\*))

<u>Function</u>	a	b	С
<b>A</b> *	1.0885	9.0557E-3	0
B*	1.0786	0	8.5001E-2
C*	.95426	0	14357

#### APPENDIX E. PROGRAM LISTINGS

We have included here the FORTRAN programs for writing the transport subroutines, as well as examples of the subroutines themselves. Some of these routines are very long for the  $H_2$ - $O_2$ - $N_2$  system (over 3500 lines for Method I). So as an example we have considered a binary mixture of  $H_2$  and  $N_2$ . This shows the main features of the programs while conserving space.

A copy of the actual flame code used is given in reference 23 of the text. Method V (constant transport) is included in this code as the default. The appropriate constant transport values for a given flame must be read in, but the subroutine itself is not rewritten.

For our other transport methods, the subroutine is written specifically for a given set of chemical species. The procedure is straightforward. We attach to TAPE15 the coefficients for computing the thermodynamic quantities. We attach to TAPE9 the least squares fits for the viscositites, thermal conductivities, and binary diffusion coefficients. There are computed in another program using the methods discussed in this article. The program also requires the appropriate Lennard-Jones (Stockmayer) parameters, the pressure, and for some methods the least squares fits for A\*, B\*, and C\*. The flame code actually works with non-dimensional forms of the flame equations, so appropriate normalization terms for the space coordinate, time coordinate, and temperature must also be supplied.

The transport statements are written onto TAPE3. This tape is read and attached to a standard set of initial statements. The corresponding FORTRAN subroutine F can then be attached to the flame code.

Given the mass fractions, the non-dimensional temperature, and their first and second space derivatives, F computes the corresponding time derivatives. The needed chemistry terms are found by calling the subroutine RT. This subroutine is also written by a FORTRAN program (see reference 22 of text).

For details on the actual form of the equations used and the connections between F and the rest of the flame code, see reference 23 of the text.

The listing that follows gives the FORTRAN program (MAIN) and the corresponding transport subroutines for a binary mixture of  $H_2$  and  $N_2$  (F) for Methods I, II, III, IV and VI.

PROGRAM LOADF 16776 OPTET MOUNDES—**Y MACE PROGRAM LOADF (MADIT MOUNDES—**Y MACE  *** TARE3. TARE3. THE SUBMOUTINE F IN POECOL-FLCT.**  *** OTHER 162 THE SUBMOUTINE F IN POECOL-FLCT.**  *** OTHER	04/15/80 14:17:09	2	MAIN 4	7	7	7	7	MAIN	(25) MAIN	MAIN	MAIN	MAIN	MAIN	7	7	7	<b>-</b> , -	<b>,</b>			7	~	-	<b>.</b>		 	-	-	_	, -			_	-	_					MAIN	· MAIN	NAIN	Z Z Z				, 7	7	Z	7
PROGRAM LOAD!  PROGRAM LOAD!  TAPE3.1APE9.  DIMENSION LB- PORMAT(11,014)  WRITE(3,1012)  WRITE(3,1012)  FORMAT(11,014)  FORMAT(12,014)		PUT.TAPL6=0UTPUT.	0L-FLCY•		7,25)	Š			*UM(25) *ALP(25) *ZROT(25) *DF					ZERO.				J(K)=SMALL )				BE READ									-	[ • 2 (/5 X • 1 H • • 1 X •			DE • IC • KSKR) )		SOLE MOMENT NOW 75001	ENNARO-JONES COLL ISLON	S ARE STUCKMAYER.		**ESK(K) *UM(K) *ALP(K) *ZROT (F		. ESK (K) . UM (K) . ALP (K) . ZROT (P	3 - 1		=1.5	-145	=1.20)	.=1 • 20)	
PROGRAM L  TAPE3.1A  DIMENSION  WRITE (3.1)  FORMAT (1.1)  FORMAT (1.2)  FORMAT (1.2)  FORMAT (1.3)  FORMAT (6.3)	= I KOUND=+-#/	DF (INPUT. UUTPUT. TAPES=IN	UTINE		B(25) + W(25) + AU (7+25) + AL (	LD (25) +8LO (25) +ABD (25+25	3PR (25)	I I (44) I I	3R01 (25) + S6A (25) +ESK (25)	)(25) •L0v (25)	V(25) • BV (25)	(25,25)	(6	2X+34HWE WANT TO AVOID D	(2)	tHDO 5 K=1.NPDEM)	(+)	CHIF (ABSIDIN) . LI. SMALLJI	2) 45°4X°36HTF (ABS (UPH(K)) .1	INE		OF COMMENT LINES	INE.		11	72AI / )	SPC				AN - (	17N=I • 0 • 8 (A I • A2 • I 2 • AI ) • A	[•AI)) )	2)	SHCALL RI (U.YN.R.NPOE.KPE	1SPC	ONE DOLAR CICELS (DIE	CAN HE APPROXIMATED HY L	IF THE INPUT PARAMETERS	PC.	LB(K) + W(K) + DF(K) + SGA(K)		(+LB(K)+W(K)+DF(K)+SGA(K)	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	AU (L·K) • L= 1•5) • (111 (L) • L	AU (L+K)+L=6+7)+(AL (L+K)+	AU (L+K) +L=6+7) + (AL (L+K) +	AL (L+K) +L=4+7) + (III (L) +L	AL (L.K) .L=4.7) . (III (L) .L	
	•	ROGRAM	LOAD	í	CIMENSION LE	DIMENSION AL	DIMENSION LE	DIMENSION II	DIMENSION LE	DIMENSION LC	DIMENSION AV	DIMENSION E	WRITE (3+1000									N.	00 20 K=1+NL	READ (5,22) I I				NM=NSPC+I	LBM=IH-	L80=2HU (	LBF = 1177 WRITE (3 - 1020		*				V	E	Z		<b>HEAD (5+32)</b>	* LBROT (K)	WRITE(6+34)K	DEAD IE 361	WRITE (6+36) (	READ (15,36) (	WRITE (6+36) (	HEAD(15+37)(		

115		D=AU(5,K) *4.0	MAIN	116
	, S.	WKITE(3.III2)K.A.B.C.D	MAIN	11.7
	<b>.</b>	:HITE (3•62) K•AU(6•K)•AU(1•K)	MAIN	118
	.5	FKITE (3,64) 4U (2,K), 4U (3,K)	MAIN	611
	3	WKITE (3.66.) AU (4.K.) • AU (5.K.)	MAIN	120
120			MATA	121
		OKMAT (6x . 1 HH . 12 . 9H=1 . 9872 * ( . I PE 1 6 . 8 . 4 H + T * ( . I PF 1 6 . 8 )	MATA	122
		ORMAT (5x .1 H* .1 x .4 H * 1 x .4 H * 1 x .4 H / 2 .0 .4 H / 2 .0 .4 H * 1 * ( .1 PE 16 .8 .4 H / 3 .0 )	N AM	123
	66 F	FORMAT (5X.1H*, IX.4H+1* (* IPE 16.8.4H/4.0.4H+1* (* IPE 16.8.	MAIN	124
	*	4H/5.0.6H]]]]]])	MAIN	125
125	3	WRITE (3+68)	MAIN	126
	68 F	F OHMAT (4H3000•2ו8HCONT INUE)	MAIN	127
		WHITE (3.134)	MAIN	128
	134 F	FURMAT(IHC+2X+39HSPECIFIC HEATS AND SPECIFIC ENTHALPIES. )	MAIN	129
	0	00 140 K=I,NSPC	MAIN	130
I30	3	₩KITE(3•I42)K•K•W(K)	MAIN	131
		RITE(3.1116)K.K.K(K)	MAIN	132
	1116 F	FURMAT (6X, 7HDC (IST+, IZ+4)=DC+ IZ+I H/+F6-Z)	MAIN	133
	131	WAXIIE (3. 144) K. Y. W. K. Y. C.	ZIV	I34
		ONLINOE	NAIN	135
c£1	247	FURMAT (6X-6HC(1S1++1Z+3H)=C+1Z+2H/+F0+Z) FURMAT (6X-6HH/1S1++12-3H)=H-12-1H/-F6	Z Z Z	136
		10/2011 (07/2011 17 17 17 17 17 17 17 17 17 17 17 17 1	2 2 4 2	1001
		MALL TELSOLITOS. FODMATITE.DHIDG.DX. BHCONTINIED	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	1 20
	*			140
071		STREET STREET STREET		141
2		THE RIGHT CONDUCTIVE THE WAY CONDUCTIVE AND DIMAGN PREFITATION	2 2	1 + 1
		IN VISCOSITY THENTHE CONDUCTION AND BINARY DIFFUSION	2 2	140
		CITILITATO TACE A TILE CREATED OF VALCEUS CITUS	2 7	7 7 7
		TOTAL TOTAL TAIL THE THE TAIL THE TAIL	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	7 7 7
37.1	KŠ	12010/11/11/11/10 0.401/11/11/11/11/11	2 2	140
C# 1		JOINT TO THE TOTAL THE TOTAL TO THE TOTAL TOTAL TO THE TO	2 2	146
	2 3	NOTE (3,22) 11	2 2 4 4 5	14.0
		ANTICOPOLITY IN THE PROPERTY OF THE PROPERTY O	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	0 0 0 1
	37.	));;   1;	ZIV	170
5.0			MATA	151
	۵	DO 70 K=1-NINF	2 T A	151
	ã.	READ (5,22) 11	MAIN	153
		WHITE (3,22) II	MAIN	154
	70 C	CONTINUE	MAIN	155
155	٥	00 80 K=I.NSPC	MAIN	156
	<b>x</b>	READ(9.82) AV (K) • BV (K) • II I	MAIN	151
	× 3	WKITE (6,84) K•LB (K)•AV (K)•BV (K)•III	MAIN	158
	3		2 2 2	661
09		CONTINUE	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	191
		FURMAT (1P2F14.6,44A1)		162
	84 F	FURMAT (/2x,14,4x,44,4x,1P2E14,6,44AI/)	MAIN	163
		00 76 K=I+NSPC	Z	164
	76 WF	WHITE (3,78)K,AV(K), bv(K)	MAIN	165
65		00 90 K=1,NSPC	MAIN	166
		WHITE (3,92) K,ALD(K), BLD(K)	MAIN	167
	06	CONTINUE	MAIN	IAR
		FURMAT(IHC.5X.2HHL.IZ.IH=.IPEI4.6.5H*(!**.IPEI4.6.1H))		691
7.03	4 00	REAUCO IZONE INF	Z Z	170
2	2 3	KEAD (5,22) 11	ZIV	1/1
			?	7 . [

0 14.17.09							217 218 220 221 224 225 226 226
04/15/80		Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z		X X X X X X X X X X X X X X X X X X X	M M M M M M M M M M M M M M M M M M M	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	MANUA
JADF 76/76 OPT=1 ROUND=+-*/ THACE FIN 4.8+498			# d.			WRITE (3*164) K*K WRITE (3.166) K*K  WRITE (3.166) K*K  CONTINUE  FORMAT (6X*1HU*12*3H=U(*12*1H))  FORMAT (6X*2HDU*12*5H=UPH(*12*1H))  FORMAT (6X*3HDU*12*6H=UPH(*12*1H))  LBU=1HU  WRITE (3.172) NSPC*((LBM*LBU*K)*K=1*NM)  FORMAT (6X*1HU*12*4H=1.0*8(A1*A1*12)*A1*2(/5X*1H**1X*)	* 8 (A1.12.41) ) LBUU=2HUU WRITE (3.174)NSPC.((LBM.LBUU.K). FURMAT(6X.2HDU.IZ.1H=.8 (A1.42.1 * 8 (A2.12.41) ) LBUDU=3HUDU WRITE (3.176)NSPC.((LRM.LBUDU.K). FORMAT(6X.3HUDU.IZ.1H=.8 (A1.43.4.43.4.43.18.2.41) ) DO 180 K=1.NSPC WRITE (3.182)K.K.W(K) CONTINUE FORMAT(6X.2HDY.1Z.3H=DU.IZ.1H/.
PROGHAM LOAUF	100	110	120 122 C 4		149 150 152	160 162 164 166	
PROG	175	180 185	190	195	200	210	<b>220 220</b> 232

S

	PRDGRAM LOADF		76/76 OPT=I KUUND=+-*/ IHACE		FIN 4.8+498	04/15/80 14.17.09	14.17.09
30	186	LEDY=2HDY WRITE (3*1R6) ((LBPL*L FURMAT(6X*4HDYS=*8(A DO 190 K=1*NSPC	LEDY=2HDY WRITE(3•186)((LHPL•LHDY•K)•K=I•NSPC) FURMAT(6X•4HDYS=•8(AI•A2•12)•AI•2(/5X•IH*•IX•8(A2•12•AI)) BO 190 K=I•APS	PC) :(/5x•IH*•IX•8	(42,12,41)))	M M M M M M M M M M M M M M M M M M M	230 231 232 233

	Leo1-2401	ZIAM	230
230		MAIN	231
	186 FURMAT(6X,4HDYS=,8(AI,AZ,1Z),AI,2(/5X,IH*,IX,8(AZ,1Z,AI))))	MAIN	232
		MAIN	223
	王り十七月 ショロのンス・ス・コード	11 4 74	200
		ZIVE	47
	ISS FURMALIOA, SHUDI + I Z + 4H = DIU 0 + I Z + 1 H / + F 6 - Z )	MAIN	235
235		MATA	236
	H PON Y = YOUN I		0 0
		2 4 2	631
	WKI IE (3*192) ((LUPL*LUDUY*K)*K=1*NSPC)	MAIN	238
	I92 FORMAT (6x,5HDDYS=,5(AI,A3,I2),AI,2(/5x,1H*,Ix,5(A3,12,AI)))	MAIN	230
			573
37.0		2	047
040	WALLE (3.6.2.4. LV) THN - IMN	MAIN	24 I
	WRITE(6,234)TPN.PHN.TMN	MATA	242
	**** A CITOL - NUCLE ** A.A. CITO		J (
	1	Z	543
	* SHIMN = 1PEI2 4	MAIN	244
	WRITE (3,242) PSP	MATA	24.0
7,76			C + C
7	545 TORMAI (64,500 KH=+1 FECU-1 C+1 KH (0   X   X   X   X   X   X   X   X   X	ZIV	246
		MAIN	747
	1202 FORMAT (6x.16HDYSY=DYS/(YS*YS))	7	2,0
			9,0
		ZTVE	V # V
	194 FURMAL(0X+18HDYSTSU=(DYS/YS) **C )	MAIN	250
250	00 I250 K=I+NSPC	MAIN	251
	FRITE(30-1704-) X • X • X	MAIN	200
	TOOK FORMATICS DUNCTO TO BUILDY OF THE CONTRACTOR OF THE CONTRACTO		202
		MAIN	253
		MAIN	254
	196 FURMAT (6X - 3HDDX - 12 - 5H = CDDX - 12 - 7H = 2 0 + DY - 12 - 13 H + DX - 2 - 2 - 0 + X - 12 -	MATA	י ני
255	4	1	(2)
623	LOWING .	MAIN	526
	ZRUT HAS	MATA	257
	IF I RROT = SH CNST. THEM TDEAT 7001 AC A		0 0
	TO TO THE TOTAL PROPERTY OF THE PROPERTY OF TH		228
	USE THE FURMULA	MAIN	526
	E H	MAIN	260
260	P1=2_0+ACOS(0_0)	N V	35.1
			103
	K47 (	MAIN	292
		MAIN	263
	0.0)60 TO IZI	MAIN	264
	8=SQRI (PI*PI*FIX (X))/2,0		36.5
265		2	COD
		NIAM	992
	A-UT (N) (2.0*ZKU) (N)	MAIN	267
	U= P ♦B	MAIN	268
	C= <b>∀</b> *C	MATA	260
	C WRITE CROIZZROI	NA TAN	101
0.10		2	0 2
· - J		ZIVE	27.1
	1	MAIN	272
	•	MAIN	273
		MAIN	276
	1207 FURMAT (6X 4 HCS 2R 12 1 H = 1 DF 20 1 1 )	2 4 4 7	1 1
275		2 4 5	5/2
1	•	ZIVW	276
		MAIN	277
	4	MAIN	278
	#	MATA	270
	IF (LBRDT (K) - EQ-LBCN) WRITE (3-1121) K	N I V	200
280	1121 FORMAT (6x squice 20 1 ) - CHEC 1		000
1	A=10 0.42 04013	Z	2HI
		MAIN	282
	STATE (GOLD) TO THE CONTRACT OF THE CONTRACT O	MAIN	283
		MAIN	2.84
	C WRITE C INTERNAL.	MAIN	285
245	A	ZIV	200
		? <b>!</b>	000

אטטאאין בטאט				
			MAIN	287
	213	WRITE(3+1212)R+K+A FOUNATION - 12-4H=C(151++12+2H)*+1PE20+12+4H=2+5)		288
	1212	CART CANAL CONTRACTOR OF THE C	MAIN	289
	4011	#KITE(34115-77,0);;;; FODMATIAX.EHDCINI:17-8H=DC(1ST+-12-2H)+-1PE20-12)	MAIN	290
	716		MAIN	291
062	7101	MALLELOYETTON (17 - 17 - 17 - 17 - 17 - 17 - 17 - 17	MAIN	262
	0121	TOTAL - 100	MAIN	293
	9011	#N1IE/J#120/120/120/120/140/120/140/120/120/120/120/120/120/120/120/120/12	_	567
	1160	CONTRACT	MAIN	295
		21.117.117.117.117.12.4	MAIN	962
295		0 1230	MAIN	297
	1210		MAIN	862
		***I_T	MAIN	562
	1	7.2. I G.C. 1.0. C.C. 1.0.	MAIN	300
	1250		MAIN	301
300		TITOD TITOD TO COLUMN TO C	MAIN	302
		1 O 1 O 1 O 1 O 1 O 1 O 1 O 1 O 1 O 1 O	MAIN	303
		NEXT   F (4+1204)   1-4+140   1-4+14	MAIN	304
	I 254	FUNDATIONAL STATEMENT OF THE STATEMENT O	MAIN	305
		WKITE (3-1256) 1-10-10-10-10-10-20-20-20-20-20-20-20-20-20-20-20-20-20	MAIN	306
305	1256	FORMAT (6X,2HUX,6Z12,3H=UX,1Z,4Z1+X,1Z,4Z1+X,4Z1,5Z1+Z)	MA	307
		A=1.0/ABU(1.0)	MAIN	308
		B=-9B0(I+1)	MA	30.9
	CHARI		MA	310
	,	WRITE (3-1258) 1-0-4-4-4 10-10-10-10-10-10-10-10-10-10-10-10-10-1	MAIN	311
310	1258	FURMAT (6X, 2HVD+2, IZ+1) FECO+12+0F-11+12+12+12+12+12+12+12+12+12+12+12+12+1	MAIN	312
				313
		0-11-0 0-1-0 1-0-1-10-10-10-10-10-10-10-10-10-10-10-1	MAIN	314
	1363	HALLE (3-1202-11-20-11		315
310	707	DOTTE (4-12/6/11-0-11-0-11-0-11-0-11-0-11-0-11-0-11		316
	1266	FORMAT (6X,3HXSD,2I2,2H=X,2I2,3H*VD,2I2)	ZIV	317
		WRITE(3+1270) ((1+J)+L=1+5)	2 2 4 2	916
	1270	FORMAT(6X,4HDXSU,212,3H=UX,212,3H*VD,212,2H+X,212,4H*UVU,212)	2 2 4 4	320
		IF (I.EQ.J)60 TO 1300		35.
320		A=5.0/(3.0*PI)	Z	322
		IF (OF (1) EGO+00-AND-0F (0) EGO+00-0F (1) ECO+12-72-1140	Z	323
		TY (OF (I) SEG-00-bN-00-bV (-) SEG-00-bV (-)	MAIN	324
	1136	TORMAL TO A DIDICATE LEVEL OF THE COMMAND OF THE CO	MAIN	325
	1212	TOWART ( DAY & STOCK ELECT & CONTRACT ( ) - 10 - 10 - 10 - 10 - 10 - 10 - 10 -	MAIN	326
363		1 (1) NF. 0.0. AND UF (4) FO.0.0 WRITE (3.1 134) I. J. A.1	MAIN	327
	1134	FORMAT (6x,3HOC7,212,1H=,1PE20,12,7H*(DC5ZR,12,1H))	MAIN	328
	1274	FORMATICKX, 24CZ, 27Z, 25H=1.0+, 1PE2U, 1Z, 6H* (CSZR, 1Z, 1H)	Z V V	329
	131	IF (OF (1) -FO. 0. 0. AND OF (J) . NE. 0. 0) WRITE (3.1274) I. J. A. J	MAIN	330
066		IF (OF (1) FD. 0.0. AND UF (J) . NE. U. U) WRITE (3.1134) 1. J. A.J.	MAIN	331
		IF (OF (1) NF. 0.0. AND UF (3) NE. U. U) WRITE (3.1276) I.J. A.I.J	MAIN	332
		1F(OE(1), NE. 0, 0, ANI) - UF(J), NE. 0.6) WRITE (3.1136) I+J+A+I+J	MAIN	333
	1136	12	MAIN	334
	1276	.2HC7.212.5H=1.0+.1PE2U.12.6H*(CSZR.12.5H+	MAIN	335
335	0061		MAIN	336
	1	LBX=1HX		33/
		LR-CH-3H+VD	Z   V	338
		X		339
		WRITE(3,1304)K, ((L.*PL.*LBX,L.*LBVD,K,L).*L=2.NSPC)	ZIV	340
340	1304	FUHMAT(6X,44HSXSD.12.1H=.5(2AI.1L.4A3.2I2).4AI.3(/5X.1H*.1X.	MAIN	34.
		* 5(AI*I2*A3*ZI2*AI)))	Z	745
		したリス=フHリス	MAIN	343

MAIN 346 MAIN 346 MAIN 347 MAIN 349 MAIN 369		2222222		MAIN 377 MAIN 378 MAIN 379 MAIN 380 MAIN 382 MAIN 384	22222222	N N N N N N N N N N N N N N N N N N N
A			12)	NTIS FORMULA.) MAII MAII MAII MAII MAII		MAII MAII MAII MULTICOMPOMENT SYSTEM MAII MAII
LBUVD=4H*DVD WRITE (3,1308)K, ((LBPL,LBUX,L,LBVU,K,L,LBPL,LBX,L,LRDVD,K,L	KREK-1 WRITE (3,1304) K, ((LRPL,LBX,L,LBVU,L,K),L=I,KM), * (LBPL,LBX,L,LBVD,KK,L),L=KP,NSPC) WRITE (3,1308) K, ((LBPL,LBDX,L,LBVU,L,K,LBPL,LBX,L,LBOVD,L,K), * L=I,KM), ((LBPL,LBDX,L,LBVD,L,K,LBPL,LBX,L,LBDVU,K,L),L=KP,NSPC CONTINUE K=NSPC WRITE (3,1304) K, ((LBPL,LBX,L,LBVU,L,K),L=1,NM) WRITE (3,1308) K, ((LBPL,LBX,L,LBVU,L,K,LBL,LBX,L,LBDVD,L,K),	L=1,NM)  D0 1325 K=1,NSPC  A=1.0/AV(K)  B=-8V(K)-I.0  E THE FCIPROCAL OF THE VISCOSITY TIMES THE TEMPERAT  WRITE(3,1312)K*A*B  A=A*B	B=B-I.0 WRITE(3,1314)K,A,B FORMAT(6X,4HDSTV,1Z,1H=,1PE20,1Z,6H*(T**(,1PE14.6,5H))*DT) FORMAT(6X,4HDSTV,1Z,1H=,1PE20,1Z,4H*STV,1Z) FORMAT(6X,4HXSTV,1Z,2H=X,2IZ,4H*STV,1Z) WRITE(3,1320)K,K,K,K,K,K,K,K,K,K,K,K,K,K,K,K,K,K,K,	HEAT OF THE MIXTURE.  LBU.K).K=I.NSPC)  46.12.43.12).A1.	D1FFUS1ON.	AND MEAT FLUX. LEWIS. ) PORT PHENOMENA IN )
LBUVO=4H*DVD WRITE (3,130B)K, ((LBPL * ,L=2,NSPC) 130B FOKMAT(6X,5HDSXSD,12, * 9(/5X,1H*,IX,2(A2,1)Z, DO 1310 K=2,NM	KP=K+1 WRITE (3,1304)K, ((LRPL,LHX,L,LBVU,L "RITE (3,1308)K, ((LBPL,LBX,L,LBVD,K,LBVX,LBVX	* L=1*NM) D0 1325 K=1*NSPC A=1.0/AV(K) B=-6V(K)-1.0 C WRITE THE RECIPROCAL OF WRITE (3,1312)K,A*B 1312 FORMAT(6X*3HSTV*12*1H A=A*B	T = U = U = U = U = U = U = U = U = U =	SPECIFIC HEAT OF THE MIXTURE.  ******************************  WRITE (3,124)  4 FORMAT (1HC,2X,44HSPECIFIC HEAT OF THE MIX LBC=6HC (1ST+ LBU=3H)*U WRITE (3,132) ((LBPL,LBC,K,LBU,K)*K=I,NSPC) WRITE (3,132) ((LBPL,LBC,K,LBU,K)*K=1,NSPC)  * 4 (/5X,1H*,1X,4 (46,12,A3,12)*A1) )	######################################	FURMAT(1HC,2X,24HU]FF FURMAT(1HC,2X,16HSEL WHITE(3,276) FURMAT(1HC,2X,60H]]. *S.
345	350 355 13	360 C 365 13	370 1316 1320 1320 1325	380 124	385 C 390 C	375 475 75 75

	PROGRAM LOAUF 76/76 OPT=I HOUND=+-*/ THACE FIN 4.8+498	04/15/80	14.17.09	PAGE
007	F ORMAT ( IP.	M M N N N N N N N N N N N N N N N N N N	402	
	WRITE(6.123)AAST.8AST.111 123 FORMAT(/2x.1P2E14.6.44AI)	MAIN	403	
	READ (5,27	MAIN	\$ 0 t	
405	WK11E (6:123) ABST (CBST:11) READ (5:279) ACST (CST:111	NA N	404	
	WRITE (6.1	NAN	408	
	C LM 00+00 WRITE (3+301)	N S	604	
	301 FORMAT(IHC, 2X, 8HLM 00,00)	ZZZ	411	
015	UO 30S K=1.0NSPC	ZIV	412	
	CONTINUE	ZZ	414	
	302 FORMAT(6X,2HZ(1Z,1H,,1Z,SH)=0.0 )	MAIN	415	
415		ZZ	416	
•	IF(I,E0,J)60 TO 310	ZIV	418	
	(T) X \ (T) X = V (T) X =	ZIV	419	
	IMAX=MAXO(I•1)	ZZ	124	
420	WRITE(3,308)I,J,IMIN,IMAX,44,J,1 30g FORMAT(6X,2HZ(4)I2,1H*,1Z*,5H)=X5U,2I2*IH*,IPE20.I2*2H*X*I2*	ZZ	422	
	* 5H*SXSD*I	ZZ	454	
	WRITE (3+31	ZIV	523	
507	* SH*SXSD*I2°2H+X*I2°6H*DSXSD*I2*IH)	ZIAZ	426	
) J	10 CONTINUE	ZIVE	428	
	SMA FOR EACH PAIR OF SPECIE	MAIN	459	
	DO 320 I=I.NSPC	ZIAN	430	
430	00 320 J=1,NSPC	ZIV	432	
	IF(I.E(0.J)60 TO 320	MAIN	433	
	IF (LIM(1) - FO. 0. 0. AND. UM(J) . EO. 0. 0) 60 TO 320	ZIV	434	
	C COMBINING RULE. P. S28, REID AND SHER#000.	ZZ	436	
438	IF (UM(I) • NE • 0 • 0) LP=1	MAIN	437	
	IT (OM (O. ME • 0 • 0 × 1 T T V OM (O. • 0 × 1 T T V OM (O. • 0 × 1 T T V OM (O. • 0 × 1 T T V OM (O. • 0 × 1 T T V OM (O. • 0 × 1 T V OM (O. • 0	MAIN	438	
	IF (LP.E0.J)LNP=I	2 Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	404	
	UMP=UM(LP)*].0E+18	MAIN	7 to 1	
0 77	TPSTAR=UMP*UMP/(ESK(LP)*RK*SGC*SGC*SGC*SQRI(H.0))	ZIQX	6 t t 2	
	FC=1.0+(1.0/SOR1(2.0)) * (ALP(LNP) *TPSTAR/(SGA(LNP) **3)) *	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	444	
	* SOAT (ESK (LP) (ESK (LP) )	MAIN	445	
777	1234 FORMAT (414, IPE12.4)	ZIVE	446	
1		ZZZ	644	
		NIAM	644	
	WRITE (3,1350)	MAIN	450	
450	1350 FORMAT (IHC. 2X. 24HFINU T*, A*, B* AND C*.	ZZZ	451	
	WN• I=I 09EI 00	MAIN	453	
		MAIN	454	
	, <u>-</u>	2 Z Z	2 4 2 0 3 4	
455		ZIVW	457	
	WXITE (3.1354) F (1.0)			

	PROGRAM LOADE	F 76/76 OPT=1 RUUND=+-*/ TRACE FIN 4.8+498	04/15/80	14.17.09	PAG
	1367	THUMATICAL TURESTATION AND AND AND AND AND AND AND AND AND AN	MATAN	2	
	*DC T	- (	MAIN	459	
	1356	FURMAT(6X,3HAST,212,1H=,1PE14,6,7H*(TS**(,1PE14,6,2H))))	MAIN	460	
460		A=AAST*BAST	MAIN	461	
		B=BAST-1.0	MAIN	462	
			Z	463	
	1366	FORMAT(6X,4HDAST,2IZ,1H=,1PEZU,1Z,1H*DIS*(IS**(,1PE14,6,2H)))	NAN	404	
777	3261	FRITE (301365) CBS1	ZIVW	405	
004	CBCT	ONEA   OO   OO   OO   OO   OO   OO   OO	Z	46.7	
		WRITE (3.1358)   RB.1.J.ABST	M	468	
	1358	FORMAT (6X, A3, 212, 1H=, 1PE14, 6, 3H*EX)	MAIN	694	
		LBUB=4HDBST	MAIN	470	
470		A==ABST*CBST	MAIN	471	
			ZIV	472	
	1368	FORMAT(6X,44,212,1H=,1PE14,6,15H*DTS*EX/(15*1S) )	2 Z 4 Z	673	
		WK1   E (3*1365) CCS	ZIVE	4/4	
475		EBC-SHCSI	ZIV	476	
1		LBDC=4HDCST	MAIN	477	
		A==ACST*CCST	MAIN	478	
		WRITE (3+1368) LB0C+1+J+A	MAIN	479	
	1360	CONTINUE	MAIN	480	
480	CLM	00+10 AND LM 10+00	MAIN	481	
			MAIN	482	
	321	MAT	MAIN	483	
		330	ZIA	787	
	•	JS=1,NSPC	MAIN	485	
485		1F(1S.EQ.JS)60 TO 330	NAM	984	
			Z	184	
		1/02 - 34 - 01 - 32 - 01 -		000	
		MINI (1.50, 1.50) - 4 - (20, 1.50) - 4 - (20, 1.50) - 4 - (20, 1.50) - 4 - (20, 1.50) - 4 - (20, 1.50) - 4 - (20, 1.50) -	MAIN	064	
064		IMAX=MAXO (ISO-US)	MAIN	164	
		WRITE (3,326) A, IMIN, IMAX	MAIN	765	
	326	FORMAT(6X,3HCT=,1PE20,12,9H*(1,2*CST,212,5H-1,0))	MAIN	667	
		A=A*1.2	MAIN	767	
6		WRITE (3) 1140) A. IMINOIMAX	Z Z	495	
640	0411	UKMA	2 2 2 2	107	
		MAX=MAXO(1) (S). (S)	MAIN	498	
		WRITE (3+328) I+J+IMIN+IMAX	MAIN	664	
	328	FUHMAT (6X+2HZ(+12+1H++12+8H)=CT*X50+212)	MAIN	200	
200		WRITE(3,1144)1,J.IMIN,IMAX,IMIN,IMAX	MAIN	501	
	1144	FORMAT (6X+2H0Z+12+1H5+12+8H=CT*UXSD+212+8H+DCT*XSD+212)	MAIN	502	
	330	CONTINGE	Z	503	
			2 3	504	
202		7 - NON - 1 - 21 - 21 - 21 - 21 - 21 - 21 - 21	Z	506	
S			MAN	507	
		[HP=1H]	MAIN	508	
		LBM=1H+	MAIN	209	
li		WKITE (3,336) II, 12, ((LBM.LBZ,K,LI)(,12,LBP),K=2,NSPC)	MAIN	510	
210	336	FORMAT(6X,2HZ(*12*1H**1Z*2H)=*5(A1*AZ*1Z*A1*1Z*A1)*A1*	Z	511	
	2	\CSA+10*+1\**\C*+1C*+10*+1\*\C*+1\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	۲۱۵ ۲۱۵	
		SHI=8871	MAIN	514	

0 I

		* 8H-4.0*AST,2I2,3H*CZ,2I2,1H) )	MAIN	572
WHITE (13-76)   1-5	,	WRITE (3+II46) A+IS+JS+JS+JS+JS+JS+IS+JS+IS+JS	MAIN	573
## CONTINUE   CONTINUE	114	* OKMAI (6X*SHUCI==*IMEZ0*IZ*IOH* (3.0*U8SI*Z1Z*9H*4.0* (ASI	Z Z Z	5/4
FORMATION CONTINUE		* ZIZ**********************************	7 7 7	6/6
######################################	326		7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	773
FORMATIGAX_2MG_122_115_45_115_45_115_411+**112*1H)			2 4	57B
### ##################################	377		MAIN	579
FORMATI (6X.2HDZ*122.1HS*1Z*3H=CT*UXSO*212*8H+DCT*XSO*212)  WHITE (13.379) JIII 11 J FORMATI (6X.2HDZ*1Z*1HS*1Z*3H=DZ*1Z*1HS*1Z) FORMATI (6X.3HDZ*1Z*1HS*1Z*3H=DZ*1Z*1HS*1Z) FORMATI (6X.3HDZ*1Z*1HS*1Z*3H=DZ*1Z*1HS*1Z) FORMATI (6X.3HDZ*1Z*1S*1S) FORMATI (6X.3HDZ*1Z*1S*1S*1S*1S*1S*1S*1S*1S*1S*1S*1S*1S*1S*	•		MAIN	CAR
### ##################################	380		MAIN	7.8T
CONTINUES CONSTANT IN UNITS OF Case 3-ATM/MULE-K SO ALL THE MAIN CONTINUES CONSTANT IN UNITS OF Case 3-ATM/MULE-K SO ALL THE MAIN REABERS. OF CONSTANT IN UNITS OF Case 3-ATM/MULE-K SO ALL THE MAIN REAERS. OF CONSTANT IN UNITS OF Case 3-ATM/MULE-K SO ALL THE MAIN REAERS. OF CONSTANT IN UNITS OF Case 3-ATM/MULE-K SO ALL THE MAIN WITE(3.3807 A.15.15 FORMATIGA. 3807 B.15.15 FORMATIGA. 3807 B	2		MAIN	582
CONTINUE  CONTIN	379		MAIN	583
DO 400 [15=1.NSPC  RAIN  ROAGE 8.00  1=15.NSPC  ROAGE 8.00  ROAGE 9.00  ROAGE	370		MAIN	5 B &
			MATA	700
		THE TOP TO THE	7149	700
USE THE GAS CONSTANT IN UNITS OF CMM**3-ATM/HOLE-K SO ALL THE HAIN WRITE 3-3824 A 15:15 A = 5.0 PRESS WIS) A 15:40 PRESS WE UNITS. A = 5.0 PRESS WIS) A 15:40 PRESS WIS) A 16:40 PRESS W		30 CO - VOD	2 2	000
ELEMENTS OF Z ARE IN THE SAME UNITS.  ## A STATE OF TESSEN THE UNITS.  ## A STATE OF T		FILE CAC CONCIANT IN UNITE OF CHASS_AIM/M() F-K CO ALL	2	000
######################################		CMENTS OF 7 ADE IN THE CAME INITS		0 0
## ## ## ## ## ## ## ## ## ## ## ## ##		CHEN S OF 2 ARE IN THE SAME	2	790
##   FORMAT (6x,382/A1-2)   FORMAT (6x,382/A1-2)   FORMAT (6x,382/A1-2)   FORMAT (6x,382/A1-2)   FORMAT (6x,340/CT=1)FE20.12.34#6/CZ.212)   FORMAT (6x,440/CT=1)FE20.12.44#6/CZ.212)   FORMAT (6x,440/CT=1)FE20.12.44#6/CZ.212)   FORMAT (6x,440/CT=1)FE20.13.60   FORMAT (6x,440/CT=1)   FORMAT (6x,440/CT=1)   FORMAT (6x,640/CT=1)   FORMAT (6x,640/C		D==10=04TXE034W (10.04KGA)	Z	965
## ## ## ## ## ## ## ## ## ## ## ## ##	Ċ		NAM	29 I
WAITE (3.338) A-15s 15S  FORMATI (6X.44HCT=1PE20.12.44+6DC2.212)  DO 390 KS=1.NSPC  IMAX=MAX0(15.KS)  IMAX=MAX0(15.KS)  IMAX=MAX0(15.KS)  IMAX=MAX0(15.KS)  MAIN  LBXSD=HNSD  MAIN  MAIN  LBXSD=HNSD  MAIN  MAIN  LBXSD=HNSD  MAIN  MAIN  LBXSD=HNSD  MAIN	382		MAIN	265
FORMATIGNAL WOUTER IPEZO. IZ.4440CZ.2IZ)  NAIN FORMATIGNAL WOUTER STANDS  IF (KS.EO. IS) 60 TO 390  IF (KS.EO. IS) 60 TO 390  IMAX=MAXO (IS.KS)  MAIN MATHER AXO (IS.KS)  MAIN MATHER STANDS  MAIN  MAIN			MAIN	593
DO 390 KS-INSPC  IMMA=MAXO (15.KS)  IMMIN (15.MKS)  IMMIN (15.MK	383		MAIN	294
If (S.E.G., 15) GO TO 390		DO 390 KS=I•NSPC	NAM	595
MAINHAINOTIS*KS)		380	MAIN	969
IMAX=MAXO([S.KS])			MAIN	597
A=7.55Ψ(IS) 9Ψ(IS) 9Ψ(IS) 9Ψ(KS)  B=3.09Ψ(IS) 9Ψ(KS)  C=4.00Ψ(IS) 9Ψ(KS)  RHT=I.0/((Ψ(IS) 9Ψ(KS))  RHTE I.0/((Ψ(IS) 9Ψ(KS))  RHTE I.0/((Γ(IS) 9Ψ(KS))  RHTE I.0/((Γ(IS) 9Ψ(IS) 9Ψ(KS))  RHTE I.0/((IS) 9Ψ(IS) 9Ψ(KS))  RHTE I.0/((IS) 9Ψ(IS) 9Ψ(IS)  RHTE I.0/((IS) 9Ψ(IS)  RHTE I.0/((IS		IMAX=MAXO(IS+KS)	MAIN	598
D=3.0*H(KS)*W(KS) C=4.0*U(KS)*W(KS) C=4.0*U(KS)*W(KS) C=4.0*U(KS)*W(KS) A=4*RMT A=4*RMT B=B8*RMT B=B8*RMT C=C*RMT B=B8*RMT C=C*RMT WRITE (3.386)KS,C*IMIN*IMAX*IMIN*IMAX C=C*RMT WRITE (3.3150)KS,C*(IMIN*IMAX*IMIN*IMAX*)*L=1.4*(DAST*212*3H*CZ*212*) WRITE (3.3150)KS,C*(IMIN*IMAX*X)*L=1.4*(DAST*212*3H*CZ*212*) WRITE (3.3150)KS,C*(IMIN*IMAX*XS FORMAT (6X,2MCT*12*IH=*) IPE20.12*,6H*(DAST*212*3H*CZ*212*) WRITE (3.3154)KS,2MCT*12*IH=*) IPE20.12*,6H*(DAST*212*3H*CZ*212*) WRITE (3.3154)KS*B*IMIN*IMAX*KS FORMAT (6X,2MCT*12*)H=*) IPE20.12*,5H*UHST*212*,3H*CT*12*) WRITE (3.3154)KS*B*IMIN*IMAX*KS FORMAT (6X,2MCT*12*)H=*) IPE20.12*,5H*UHST*212*,4H*UCT*12*) WRITE (3.3154)KS*B*IMIN*IMAX*KS FORMAT (6X,2MCT*12*)H*IM*1MAX*KS FORMAT (6X,2MCT*12*)H*IM*1MAX*KS FORMAT (6X,2MCT*12*)H*IM*1MAX*KS FORMAT (6X,2MCT*12*)H*IM*1MAX*KS FORMAT (6X,2MS*C)H*IM*1MAX*MS FORMAT (6X,2MS*C)H*IM*MS*MS FORMAT (6X,2MS*C)H*IM*MS*MS FORMAT (6X,2MS*C)H*IM*MS*MS*MS*MS*MS FORMAT (6X,2MS*C)H*IM*MS*MS*MS*MS*MS*MS*MS*MS*MS*MS*MS*MS*MS		A=7.05 = 2 (IS) + 2 (IS) + 6.25 = 2 (XS) + 2 (XS)	MAIN	599
C=4.0*W(IS)*W(KS))**E)  RMT=I_0((W(IS)*W(KS))**E)  RANT A=A*RMT B=B*RMT FORMAT(6.4.2HCT*12.1H=*)PE20.12**4H*AST*212*3H*CZ*212) WRITE(3*,1150)KS*C**(IMIN*IMAX*)*L=1,4) FORMAT(6.4.2HCT*12.1H=*)PE20.12**1H*O*DE20.12**3H*CZ*212**) WRITE(3*,1150)KS*C**12**1H*O*DE20.12**1H*O*DE20.12**3H*CZ*212**) WRITE(3*,1150)KS*S**1MIN*IMAX*KS FORMAT(6.4.2HCT*12.1H=*)PE20.12**1H*O*DE20.12**4H*BST*212**3H*CT*12**) WRITE(3*,1154)KS*B**IMIN*IMAX*KS FORMAT(6.4.3HCT*12**2H=***)PE20.12**5H*DHST*212**4H*DCT*12**) MAIN LHDXSD=3HBXSD LHDXSD=3HBXSD LHDXSD=4HDXSD LBCT=3H*CT LHDXSD=3HBXSD LBCT=3H*CT LHDXSD=3HBXSD LBCT=3H*CT LHDXSD=3HBXSD LBCT=3H*CT LHDXSD=4HDXSD LBCT=3H*CT LHDXSD=3HBZ*D*** LBCT=3H*CT LBCT=3H*CT LBCT=3H*CT LBCT=3H*CT LBCT=3H*CT LBCT=3H*SD LBCT=3H*SD LBCT=3H*SD LBCT=3H*SD LBCT=3H*SD LBCT=3H*SD LBCT=3HSSD LBCT=3HSD LBCT=3HSD LBCT=3HSD LBCT=3HSD LBCT=3HSD LBCT=3HSD LBCT=3HSD LBCT LBCT LBCT LBCT LBCT LBCT LBCT LBCT		B=0.0 ± 0 € X (XS) ₹ X (XS)	NIAM	909
##IN ##IN ##IN ##IN ##IN ##IN ##IN ##IN		C=4 • 0 + × (IS) + × (KS)	MAIN	109
A=A*RMT B=B*RMT C=C*RMT WRITE (3*386)KS*C*IMIN*IMAX*IMIN*IMAX C=C*RMT WRITE (3*386)KS*C*IMIN*IMAX*IMIN*IMAX F ORMAT(6X*2HT)*IVIN*IMAX*IMIN*IMAX*IMIN*IMAX*IX F ORMAT(6X*3HDCT*IZ*IH*) IPEZ0*IZ*4H*6DST*Z1Z*3H*CZ*Z1Z*) MAIN WRITE (3*1150)KS*A**I*IMIN*IMAX*KS CORMAT(6X*3HDCT*IZ*IH*) IPEZ0*IZ*4H*6DST*Z1Z*3H*CZ*Z1Z*) MAIN WRITE (3*1154)KS*A**I*IMIN*IMAX*KS F ORMAT(6X*2HCT*IZ*IH*) IMAX*KS F ORMAT(6X*3HDCT*IZ*ZH=**) IPEZ0*IZ*4H*6DST*ZIZ*3H*CT*IZ* CONTINUE LBXSD=3HXSD LBXSD=3HXSD LBXSD=4H9XSD LBXSD=4H9XSD LBCT=3H*CT LBXSD=3HXSD LBCT=3H*CT LBXCT=3H*CT LBXT LBXT LBXT LBXT LBXT LBXT LBXT LBX		RMT=I.0/((W(IS)+W(KS))*+2)	MAIN	602
## BEBRRY    BEBRRY		A=A*RMT	NAM	603
C=C**RMT WRITE (3,386)KS*C*IMIN*IMAX*IMAX FORMAT (6X,2HCT*12*)H=*;IPE20.12*4H*AST*212*3H*CZ*212) MAIN WRITE (3,31150)KS*C*((IMIN*IMAX)*L=1,4) FORMAT (6X,2HCT*12*)H=*;IPE20.12*6H*(DAST*212*3H*CZ*212*) AAIN **A++AST*212*4H*DCZ*212*IH)) **RITE (3,38R)KS*A*B*IMIN*IMAX*KS FORMAT (6X,2HCT*12*)H=*;IPE20.12*6H*(DAST*212*3H*CZ*212*) **RAIN **RITE (3,38R)KS*A*B*IMIN*IMAX*KS FORMAT (6X,2HCT*12*)H=*;IPE20.12*6H*UBST*212*3H*CT*12*) **RAIN **RITE (3,31154)KS*B*IMIN*IMAX*KS FORMAT (6X,2HCT*12*)H=*;IPE20.12*6H*UBST*212*4H*UCT*12*) **RAIN **LBXSD=3H*XSD LBXSD=3H*XSD MAIN MAIN ************************************		B=8*RMT	MAIN	<b>604</b>
WRITE (3-386)KS-C-IMIN-IMAX IMAX WRITE (3-386)KS-C-IMIN-IMAX FORMAT (6X-2HCT-IZ-1H=-1PEZ0-1Z-4H+8ST-2IZ-3H+CZ-2IZ-) MAIN WRITE (3-1ISO)KS-C-((IMIN-IMAX)-L=1-4) FORMAT (6X-3HDCT-IZ-1H=-1PEZ0-1Z-6H+(DAST-2IZ-3H+CZ-2IZ-) WRITE (3-31R5)KS-A-H-IMIN-IMAX-KS FORMAT (6X-2HCT-IZ-1H=-1PEZ0-1Z-1H+-1PEZ0-1Z-4H+8BST-2IZ-3H+CT-1Z-1H1PEZ0-1Z-4H+BST-2IZ-3H+CT-1Z-1H1PEZ0-1Z-1H1PEZ0-1Z-4H+BST-2IZ-3H+CT-1Z-1H1PEZ0-1Z-1H1PEZ0-1Z-4H+BST-2IZ-3H+CT-1Z-1H1PEZ0-1Z-1H1PEZ0-1Z-4H+BST-2IZ-3H+CT-1Z-1H1PEZ0-1Z-4H-BST-2IZ-3H+CT-1Z-1H1Z-9H1PEZ0-1Z-4H+BST-2IZ-3H+CT-1Z-1H1Z-9H		C=C*RMI	MAIN	909
FORMAT(6X, 2HCT+12+1H=+) IPE20, 12+4H*AST+2I2+3H*CZ+2I2)  WRITE (3+150 KS)-(IMIN+1MAX)+L=1+4)  FORMAT(6X, 3HDCT+12+1H=+) IPE20, IZ+6H*(DAST+2I2+3H*CZ+2I2+)  * 4H+AST+2I2+4H*DCZ+2I2+1H++) IPE20, IZ+6H*(DAST+2I2+3H*CZ+2I2+)  * 4H+AST+2I2+4H*DCZ+2I2+1H++) IPE20, IZ+6H*(DAST+2I2+3H*CZ+2I2+3H+CT+I2+1H++) IMAX+KS  FORMAT(6X, 2HCT+12+1H=+) IPE20, IZ+1H=+) IPE20, IZ+4H*BST+2IZ+3H+CT+I2+1BAX+KS  FORMAT(6X, 2HCT+12+1H=+) IZ+9H=-++ IPE20, IZ+4H*BST+2IZ+3H+CT+12+12+12+12+12+12+12+12+12+12+12+12+12+			MAIN	909
WRITE(3:1150) KS.C. ((IMIN:IMAX): L=1.44)  0 FORMAT(6X; 3HDCT:12:1H=:1PE20.12:6H*(DAST;212:3H*CZ;212.)  WAIN  WAITE(3:3RR)KS:A*H*UCZ;212:1H)  WRITE(3:3RR)KS:A*H*UCZ;212:1H)  WRITE(3:3RR)KS:A*H*UCZ;212:1H=:1PE20.12:6H*UHST;212:3H*CZ;212:3H*CT;12)  WRITE(3:1154)KS:B*:IMIN:IMAX;KS  FORMAT(6X;3HDCT:12:2H=-,1PE20.12:1H,1PE20.12:4H*UCT;12)  WRITE(3:1154)KS:B*:IMIN:IMAX;KS  CONTINUE  LBX50=3HX50  RAIN  MAIN  WRITE(3:392)I:I:IS:((LBM*LBXSD:IS:KS*LBCT*KS;VAI)))  WRINE(3:392)I:I:IS:IS:((LBM*LBXSD:IS:KS*LBCT*KS;VAI)))  WRINE(3:392)I:I:IS:IS:((LBM*LBXSD:IS:KS*LBCT*KS;VAI)))  WRINE(3:394)I:I:IS:IS:IM*S*IZ:AH**IX*A*(A3:CI*XSTV*IZ*AI*A4*)  WRINE(5X:2HDCT*KS)*KS=2*WSPC)  WRINE(5X:2HDCT*KS)*KS=2*WSPC)  WRITE(3:394)I:I:IS:IM*S*IZ*AI*II*II*A*)  WRINE(5X:2HDCT*KS)*KS=2*WSPC)  WRINE(5X:2HDCT*KS)*WS=2*WSPC)  WRINE(5X:2HDCT*KS)*WS=2*WSPC)  WRINE(5X:2HDCT*KS)*WS=2*WSPC)  WRINE(5X:2HDCT*KS)*WS=2*WSPC)  WRINE(5X:2HDCT*KS)*WS=2*WSPC)  WRINE(5X:2HDCT*KS)*WS=2*WSPC)  WRINE(5X:2HDCT*KS)*WS=2*WSPC)  WRINE(5X:2HDCT*KS)*WS=2*WSPC)  WRINE(5X:2HDCT*KS)*WS=2*WSPC)	386		MAIN	209
0 FORMAT(6X,3HDCT.12.1H=.1PE20.12.6H*(DAST.212.3H*CZ.212.7.)  # 4H+AST.212.4H*UCZ.212.1H)  # 8H+AST.212.4H*UCZ.212.1H)  # 8H+AST.212.4H*UCZ.212.1H)  # 8H+AST.212.4H*UCZ.212.1H)  # 8H+AST.212.4H*UCZ.212.1H)  # 8H+AST.212.4H*UCZ.212.1H  # 8H+AST.212.4H*UCZ.212.1H  # 8H+AST.212.4H*UCZ.212.1H  # 8H+AST.212.4H*UCZ.212.1H  # 8H+AST.212.3H*CT  # 8H+A			MAIN	608
* 4H+AST.2I2.4H*UCZ.2I2.1H) )  WRITE (3.3RR)KS.A+H*UCZ.2I2.1H) )  WRITE (3.3RR)KS.A+H*UCZ.2I2.1H) )  WRITE (3.3RR)KS.A+H*UZ.1H=\IPE20.I2.1H-\IPE20.I2.4H+BST.2I2.3H+CT.I2) MAIN  FORMAT (6X.2HCT.12.1H=\IPE20.I2.1H+\IPE20.I2.4H+UCT.I2) MAIN  CONTINUE  LBXSD=3HXSD  LBXSD=3HXSD  LBXSD=3HXSD  LBXSD=3HXSD  LBXSD=3HXSD  LBCT=3H+CT  MAIN  WRITE (3.394) I:1:1S·1S·1S·1H*·1X·4 (A3·2I2.A3·1Z.AI) )  MAIN  * KS·LHDCI*KS)·KS=2·WSPC)  * KS·LHDCI*KS)·KS=2·WSPC)  * KS·LHDCI*KS)·KS=2·WSPC)  * KS·LHDCI*KS)·KS=2·WSPC)  * KS·LHDCI*KS)·KS=2·WSPC)  * ZIZ.A4·1Z·AI.A3·IZ·AI.IA3·IX·A2(A4·2I2.A3·IZ·AI.A3·IA3·IA3·IA3·IA3·IA3·IA3·IA3·IA3·IA3·I	115	FURMA1 (6X, 3HDCT, I2, IH=, 1PE20, I2, 6H* (DAST, 212, 3H*CZ, 21	NAM	609
WRITE(3.3RR)KS.A.B.IMIN.IMAX.BS FORMAT(6X,2HCT.12.1H=.1PE20.12.1H=.1PE20.12.4H+BBST.212.3H+CT.12) MAIN WRITE(3.1154)KS.B.IMIN.IMAX.KS FORMAT(6X,2HCT.12.1H=.1PE20.12.1H+DBST.212.3H+CT.12) MAIN LBXSD=3HXSD LBXSD=3HXSD LBXSD=4HDXSD LBXSD=3HXSD LBCT=3H+CT LBCT LBCT LBCT LBCT LBCT LBCT LBCT LB		*	MAIN	610
FORMAT(6X,2HCT,12,1H=,1PE20,12,1H=,1PE20,12,4H+BST,212,3H+CT,12)  WRITE(3,1154)KS,8,1MIN,1MAX,KS  WRITE(3,1154)KS,8,1MIN,1MAX,KS  CONTINUE  LBXSD=4HDXSD  LBXSD=3HXSD  LBCT=3H*CT  LBCT=3H*CT  LBCT=3H*CT  LBCT=3H*CT  IF (1S,CT) 10 393  WRITE(3,392)1,11,15*(LBM*LBXSD *1S*KS*LBCT*KS)*KS=2*NSPC)  MAIN  WRITE(3,392)1,11,15*(LBM*LBXSD *1S*KS*LBCT*KS,1A1,A1))  WRITE(3,394)1,11,15*(LBM*LBXSD *1S*KS*LBCT*KS*LBM*LBXSD*1S*MAIN  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*KS*LBCT*KS*LBM*LBXSD*1S*MAIN  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*KS*LBCT*KS*LBM*LBXSD*1S*MAIN  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*KS*LBCT*KS*LBM*LBXSD*1S*MAIN  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*KS*LBCT*KS*LBM*LBXSD*1S*MAIN  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*KS*LBCT*KS*LBM*LBXSD*1S*MAIN  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*KS*LBCT*KS*LBM*LBXSD*1S*MAIN  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*KS*LBCT*KS*LBM*LBXSD*1S*MAIN  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*KS*LBCT*KS*LBM*LBXSD*1S*MAIN  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*KS*LBCT*KS*LBM*LBXSD*1S*MAIN  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*MAIN)  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*MAIN)  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*MAIN)  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*MAIN)  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*MAIN)  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*MAIN)  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*MAIN)  WRITE(3,394)1,11,15*(LBM*LBXSD*1S*MAIN)  WRITE(3,394)1,11,115*(LBM*LBXSD*1S*MAIN)  WRITE(3,394)1,110*(MAIN*LBXSD*1S*MAIN)  WRITE(3,394)1,110*(MAIN*LBXSD*1S*MAIN)  WRITE(3,394)1,110*(MAIN*LBXSD*1S*MAIN)  WRITE(3,394)1,			MAIN	611
#RITE(3.1154)KS.8.1MIN.1MAX.KS  # FORMAT(6X,3HDCT.12.2H=1PE20.12.5H*DHST.2I2.4H+DCT.12)  # CONTINUE  CONTINUE  LBXSD=3HXSD  LBXSD=3HXSD  LBXSD=3HXSD  LBXSD=3H*CT  LBCT=3H*CT  LBCT=3H*CT  LBCT=3H*CT  LBCT=3H*CT  LBCT=3H*CT  LBCT=3H*CT  LBCT=3H*CT  LBCT=3H*CT  LBCT=3H*CT  RAIN  # RITE(3.392)I.11.15.(LBM.LBXSD .1S.KS.LBCT.KS).KS=2.NSPC)  # MAIN  # RITE(3.392)I.11.15.(LBM.LBXSD .1S.KS.LBCT.KS).RMSD.1S.MAIN  # KS.LBCT.XS).KS=2.NSPC)  # KS.LBCT.XS).KS=2.NSPC)  # KS.LBCT.XS).KS=2.NSPC)  # KS.LBCT.XS).KS=2.NSPC)  # KS.LBCT.XS).KS=2.NSPC)  # MAIN  # SIZ.A4.1Z.A1.A3.ZI.A1.A4.  # AND TANLA TO TANLA	388		MAIN	612
### FORMAT(6X,3HOCT.12.2H=**IPE20.I2.5H*DHST.2I2.4H+UCT.12) ###IN CONTINUE CONTINUE LBXSD=3HXSD LBXSD=3HXSD LBXSD=3HXSD LBXSD=3HXSD LBXSD=3HXSD LBXSD=3HXSD LBCT=3H*CT LBCT=3H*CT LBCT=3H*CT LBCT=3H*CT LBCT=3H*CT LBCT=3H*CT LBCT=3H*CT LBCT=4H*DCT MAIN ##IF(IS.6T.I)60 T0 393 ##IN F(IS.6T.I)60 T0 393 ##IN F(IS.6T.I)			MAIN	613
CONTINUE LBXSD=3HXSD LBXSD=3HXSD LBDXSD=4HDXSD LBCT=3HPCT LBDCT=4H*BCT LBCT=3H*CT LBDCT=4H*BCT LBCT=3H*CT LBDCT=4H*BCT LBCT=3H*CT LBCT=4H*BCT IF (1S.61.1) 60 TO 39.3 WRITE (3.392) I.	115		MAIN	614
LBXSD=3HXSD LBDXSD=4HDXSD LBDXSD=4HDXSO LBCT=3H*CT LBCT=3H*CT LBUCT=4H*DCT LBUCT=4H*DCT LBUCT=4H*DCT LF (1S.67.1) 60 TO 393 WRITE (3.392) 1.11.5.4 (LBM*LBXSD *1S.*KS*LBCT*KS)*KS=2*NSPC) MAIN FURMAT (6X.2HZ(*12*1H***) 1.2*9H) = CT*XSTV*1Z** * 2(AI*A3*2I2*A3*I2)*A1*5(/5X*1H***IX**4(A3*2I2*A3*I2*A1)) ) WRITE (3.394) 1.11.5.1S**(LBM*LBXSD*1S*KS*LBCT*KS*LBM*LBXSD*1S*, MAIN * KS*LHDCT*KS)*KS=2*NSPC) FURMAT (6X.2HZ(*12*1H***IZ**9H=CT*UXSTV*IZ***3H***IX**A1*A1**, MAIN * 2IZ**A4*IZ**A1*A3**ZIZ**A4*IZ**A1*IX**IX**A1*A4*, MAIN * 2IZ**A4*IZ**A1*IX**A1*IX**A1*IX**A1*A1**, MAIN * 2IZ**A4*IZ**A1*IX**A1*IX**A1*A1**, MAIN	390		MAIN	615
LBCT=3H+CT LBCT=3H+CT LBCT=3H+CT LBCT=3H+CT LBCT=4H+DCT LBCT=4H+DCT LBCT=4H+DCT IF (IS.61 I) GO TO 393 IF (IS.61 I) GO TO 393 IF (IS.62 I) GO TO 393 IF (IS.61 II) GO TO 393 IF (IS.61 II) GO TO 393 IF (IS.61 III) GO TO 393 IF (IS.61 III) GO TO 393 IF (IS.61 IIII) GO TO 393 IF (IS.61 IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII		LBXS0=3HXSD	MAIN	616
LBCT=3H*CT LBCT=4H*CT LBCT=4H*DCT LBDCT=4H*DCT LBDCT=4H*DCT LBDCT=4H*DCT LBDCT=4H*DCT LBDCT=4H*DCT LBCT=512:05 TO 393 MAIN WRITE(3-392)1-11*15*((LBM*LBXSD *1S*KS*LBCT*KS)*KS=2*NSPC) MAIN * Z(AI*A3*Z1Z*A1*12*)+1**1Z*94)=CT*XSTV*1Z* * Z(AI*A3*Z1Z*A1*12*)+1**1Z*94)=CT*XSTV*1Z* * Z(AI*A3*Z1Z*A1*12*)+1**1Z*94)=CT*XSTV*1Z* * MAIN * KS*LHDCT*KS**1**1Z**1**1Z**1**1Z**1**1Z**1**1Z**1**1		LBDXSD=4HDXSD	MAIN	617
LUDCT=4H*DCT  IF (IS.GT.1) GO TO 393  WRITE (3.392) I.1.15. (LLBM.LBXSD .IS.KS.LBCT.KS).KS=2.NSPC)  MAIN  FURMAT(6X.2HZ(.12.1H12.9H)=CT*XSTV.12.  * Z(AI.A3.2HZ.12.1A.1.12.1H1Z.9H)=CT*XSTV.12.  * RS.LBCT.KS.LBXSD.IS. (LBM.LBXSD.IS.KS.LBXSD.IS.)  MAIN  * KS.LHDCT.KS).KS=2.NSPC)  FURMAT(6X.2HDZ.12.1HS.12.9H=CT*UXSTV.12.9H*DCT*XSTV.12.A1.A4.)  * ZIZ.A4.12.A3.12.A1.A3.		LBCT=3H*CT	MAIN	618
If (IS.GT.I)GO TO 393 WRITE(3.392)I.11.60 TO 393 WRITE(3.392)I.11.61S.((LBM.LBXSD .IS.KS.LBCT.KS).KS=2.NSPC) MAIN FURMAT(6X.2HZ(.IZ.1HIZ.9H)=CT*XSTV.IZ.  * Z(AI.A3.2IZ.A3.IZ)A1.55(/SX.1H*.IX.4 (A3.2IZ.A3.IZ.AI)) WRITE(3.394)I.11.61S.1S.((L9M.LBUXSD.IS.KS.LBCT.KS.LBM.LBXSD.IS.) MAIN * KS.LBDCT.KS).KS=Z.NSPC) FURMAT(6X.2HDZ.IZ.A.PS) * ZIZ.A3.IZ.A1.A4.  * ZIZ.A3.IZ.A1.A3.ZIZ.A4.IZ.A1.IU(/5X.1H*.1X.Z(A4.ZIZ.A3.IZ.A1.A4.) MAIN * ZIZ.A4.1Z.A1)) * ZIZ.A4.1Z.A1.)		LBUCT=4H*DCT	MAIN	619
WRITE(3.392)I.J.S.((LBM.LBXSD .IS.KS.LBCT.KS).KS=2.NSPC) MAIN FURMAT(6X,2HZ(.IZ.)H+.IZ.9H)=CT*XSTV.IZ.  * Z(AI.A3.2IZ.A3.IZ).A1.5(/5X.]H*.IX.4(A3.2IZ.A3.IZ.AI)) WRITE(3.394)I.J.IS.IS.((LBM.LBUXSD.IS.KS.LBCT.KS.LBM.LBXSD.IS.) * KS.LHDCT.KS).KS=Z.NSPC) FURMAT(6X.2HDZ.IZ.HS.IHS.IZ.9H=CT*UXSTV.IZ.9H+UCT*XSTV.IZ.AI.A4.) * ZIZ.A3.IZ.AI.A3.ZIZ.A4.IZ.AI.IU(/5X.]H*.IA.Z(A4.ZIZ.A3.IZ.AI.A4.) * ZIZ.A4.IZ.AI.)) * AND		IF (IS,GT,I)60 TO 393	MAIN	620
FURMAT(6X,2HZ(,1Z,1H+,1Z,9H)=CT*XSTV,1Z, * Z(AI,A3,2IZ,A3,1Z),A1,5(/5X,1H*,IX,4(A3,2IZ,A3,1Z,AI)) ) MAIN * RS,LHOT,A3,394)I-11-15-15-((LBM,LBUXSD,1S,KS,LBCT,KS,LBM,LBXSD,1S, MAIN * KS,LHOCT,KS)-KS=Z,NSPC) FURMAT(6X,2HUZ,1Z,1H5,1Z,9H=CT*UXSTV,1Z,9H+UCT*XSTV,1Z,A1,A4, MAIN * Z1Z,A3,1Z,A1,A3,A3,2IC,A4,1Z,AI,1U(/5X,1H*,1X,2(A4,2I2,A3,1Z,AI,A3, MAIN * Z1Z,A4,1Z,A1))		WRITE (3-392) I+I+I5+ ( (LBM+LBXSD + IS+KS+LHCI+KS) +KS=2+NSPC)	Z	621
* 2(AI.43.2I2.43.12).41.5(/5X.1H*.IX.4(A3.2I2.43.12.41)) ) MAIN WRITF(3.394)I.1.15.1S.((LBM.LBUXSD.1S.KS.LBCT.KS.LBM.LBXSD.1S.) MAIN KS.LHDCT.KS).KS=2.45PC)  * KS.LHDCT.KS).KS=2.45PC)  FURMAT (6X.2HDZ.1Z.1HS.IZ.9H=CT*UXSTV.IZ.9H+UCT*XSTV.IZ.41.44.) MAIN * ZIZ.43.1Z.41.43. MAIN * ZIZ.44.1Z.41.1))	392	FURMAT (6X,2HZ(,12,1H+,1Z,9H)=CT+xSTV,1Z,	MATA	629
WRITE (3.394) I.I.IS.IS. (LBM.LBUXSD.IS.KS.LBCT.KS.LBM.LBXSD.IS. MAIN  * KS.LHDCT.KS).KS=2.NSPC)  * KS.LHDCT.KS.2HDZ.IZ.IX.BPC)  FURMAT (6X.2HDZ.IZ.IX.BPC)  * ZIZ.A3.IZ.A1.A3.ZIZ.A4.IZ.A1.IU(ZX.IH*,1X.Z(A4.ZIZ.A3.IZ.A1.A3. MAIN  * ZIZ.A4.IZ.A1) )		* 2(AI, 43, 212, 43, 12), 41, 5(/5%, 14*, 1x, 4 (A3, 212, 43, 12, 41))	MATA	623
* KS.LHDCT.KS).KS=2.MSPC) FURMAI(6X.2HDZ.I2.HS.I2.9H=CI*UASIV.I2.9H+DCI*XSIV.I2.AI.A4. MAIN * ZIZ.A3.I2.AI.A3.ZIC.A4.I2.AI.IU(75X.IH*,1X.Z(A4.ZIZ.A3.IZ.AI.A3. MAIN * ZIZ.A4.I2.AI.) )		*RITE (3,394) I+I+IS+IS+((LBM+LBDASD+IS+KS+LBCT+KS+LBM+RASD+IS+	MATA	456
FURMAT (6x,2HDZ,12,1HS,1Z,9H=CI*UASTV,1Z,9H+UCI*XSTV,1Z,A1,A4, MAIN * 2I2,A3,I2,A1,A3,2Ic,A4,IZ,A1,IA,IK,Z(A4,2IZ,A3,IZ,A1,A3,A1,A1,A1,A1,A1,A1,A1,A1,A1,A1,A1,A1,A1,			MATN	625
* 212.43.12.41.43.21c.44.12.41.10(/5x.14*,1x.2(44.212.43.12.41.43. MAIN * 212.44.12.41) ) MAIN	394	FORMAI (6X.2HDZ.12.12.145.12.9H=CI + UASIV.17.9H+UCI + XSIV.12.41.44.	MATA	426
MATA		* 212.43.12.41.43.21.c.44.12.41.6(75x.114.14.2(44.212.41.41.41.41.41.41.41.41.41.41.41.41.41.	MATA	627
		* 2 2-44-12-4 1) )		007

PAGE							
14.17.09	629 631 632 634 634	633 633 638 640 641	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	651 653 653 654 655 655	655 665 661 662 663 663 663	666 668 669 670 671 673	6776 6776 6778 6779 6779 6770 6770 6770 6770
04/15/80	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z		7	77777777 		Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z
РКОGКАМ LOADF 76/76 OPT=I KOUND=+-*/ 1КАСЕ FIN 4.8+498	*	* * *	400 CONTINUE C LM 10.01 AND LM 01.10 C C HOWS OF LM 01.10 AND COLUMNS OF LM 10.01 CURRESPONDING TO MUNATOMICS C RE ELIMINATED. WRITE(3.401) 401 FORMAT(1HC.2X.2IHLM 10.01 AND LM 01.10 ) DO 420 JS=1.NSPC DO 420 JS=1.NSPC TF (12.50.15.16) 420	IF (DF (JS) - EQ - 0 - 0) GO TO 420 IMIN=MINO (IS - JS) IMAX=MAXO (IS - JS) I = IS + NSPC J=LD (JS) + 2 + NSPC A = I0 - 0 + W (JS) + W (JS) ))	WRITE (3.40 FORMAT (6X. WRITE (3.11) FORMAT (6X. SH*DCSC*1 WRITE (3.40)	CUNTINUE  U0 450 IS=1.NSPC  IF (IS) *E0.0.0) GO TO 450  I=IS+NSPC  A=25.0*PRESS*W(IS) / (3.0*PI*RGA)  WHITE (3.422) A.IS  WHITE (3.1160) A.IS	160
	630	635	645	650	099	670	675

685	430	CONTINUE	MAN	686
		LBUCT=3HDCT LBXSD=4H*XSD	MAM	688 689
069	630	LBUXSD=5H*DXSD IF (IS.GT.1)G0 TO 433 WRITE(31.432)I.4)J1S.4(LBPL.LBCT.KS.LBXSD .IS.KS).KS=2.NSPC) FORMATIC(X.2H7.4.12.1H	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	690 691 692
	136	* 5(/5x, H*, X,+(4z, 12,4,+212,4)	Z Z Z	694
695	76.9	#K1[E\3]#43#71#59#13#13#1\CBFL#COC!#N3#EBDX3U#13#N3#EBDC-!# # K5\EBXSD#1S#X5)#X5#Z#NSPC) #FODM#T*K*: JUDY-13-146#13#DU#CT#\YCTX: 13-0U#CCT#YGTX: 13-	Z Z Z	696 696
	101	* AI.A2, I2.45, 2I2.41.43, I2.44, 2I2.41.10(/5X, IH*, IX.	MAIN	69B
		* <(AZ.1Z.AS.2IZ.AI.A3.IZ.A4.2IZ.A]) ) 60 TO 440	MAIN	669 700
700	433	IF(IS.LT.NSPC)G0 TO 436 WRITE(3.432)I.J.IS,((LBPL.LBCT.KS.LBXSD .KS.IS).KS=I.NM)	MAMIN	701
		<pre>#RITE(3,434)I,J,IS,IS,((LBPL,LBCT,KS,LBUXSD,KS,IS,LBPL,LBDCT, * KS,LBXSD,KS,IS),KS=I,NM)</pre>	MAIN	703
705	76.7	G0 T0 440	MAIN	705
	100	IMBIS-I	MAIN	707
		ייי וביי וביי	MAIN	708
		***!!E(3,4,32)!,J,15,1(LBPL,LBC!,*X5,LBX5U_,*X5,15),*X5=1,1M); * ((LBPL,LBCT,*X5,LBX5U_,1S,XS),*X5=1P,NSPC)	M M M	710
710		SU, KS+1S+LBPL+LBDCT+	MAIN	711
		* ^>,LBX>U,K>,IS,K>,IS),K>=I,IM),((LBPL,LBC),KS,LBUX>U,IS,KS,LBPL,LBUC), * KS,LBXSO,IS,KS),KS=IP,NSPC)	Z Z Z	712
	044	CONTINUE	MAIN	714
715	420	CONTINUE DO 41R 15=1*NSPC	ZIVE	715
		00 4IB JS=1+NSPC	MAIN	717
		IF(DF(IS).EQ.0.0)60 TO 4IB	MAIN	718
		7=75-1-25-1-25-1-25-1-25-1-25-1-25-1-25-1-	MATA	617
720			MAIN	721
	412	FORMAT(6X,2HZ(12,1H,,1Z,4H)=Z(,1Z,1H,,1Z,1H))	MAIN	722
	416	MRITE(31410/110/10)1 FORMAT(6X42HDZ41241HS41243H=DZ41241HS412)	MAIN	724
<u> </u>	418		MAIN	725
627	S S S S S	LM 01+01 ROWS AND COLUMNS OF LM 01+01 CORRESPONDING TO MONATOMICS ARE DELETED.	MAN	726
	127	3+451)	MAIN	728
	,	460 IS=I+NSPC	MATA	730
730			MAIN	731
			MAIN	732
		I * (U* (IS) * Eu*U*U*U*U*(JS) * EU*U*U) 60   0 460 I=LD(IS) * 2*NSPC	ZZ	733
		J=LD(JS)+2*NSPC	MAIN	735
735	460	#RITE(3,362)I,J	MAIN	736
		1981 - 18 1881 - 1881 - 1881 - 1881 - 1881 - 1881 - 1881 - 1881 - 1881 - 1881 - 1881 - 1881 - 1881 - 1881 - 1881 - 1881	Z Z W	73R
			MAIN	739
140		DO 490 IS=I+NSPC IF (DF (IS).EQ.0.0)60 TO 490	MAIN MAIN	741
		I=LD(IS)+2*NSPC		742

PROGRA	PROGRAM LOAUF	76/76 OPT=I HOUND=+-*/ THACE FTN 4.8+498	04/15/80	14.17.09	
		WRITE (39,462) IS	MAIN	743	
	794	FORMAT (6X, 14HCTM=-6.25/CINT, 12)	-	744	
		WRITE (3-1166) IS-1S-1S-1S	Z Z	7,45	
.45	1166	CCINI + 12+2H*CINI + 1Z+IH	2 Z	747	
			MAIN	748	
	466	FORMAT(6X 3HCT= 1PEZU 12 4H*CSC 12)	MAIN	440	
	9	WRITE(3,1170)A,1S	MAIN	150	
.50	1170	FORMAT (6X,4HDCT=,1PE20,12,5H*DCSC,12)	ZIV	751	
		00 470 KS=I+NSPC	Z	257	
		IF (IS,EQ,KS) 60 TO 470	2 2	75,	
		A=1Z*0***(IS) / (S*0***1***(NS))	ZIV	755	
i i		LATANT NUCLES AND THE NUMBER OF THE NUMBER O	MAIN	756	
		WRITE (3,472)KS, A, IMIN, IMAX, IS	MAIN	151	
	472	FORMAT (6X+2HCT+12+5H=1.0++1PE20.12+4H*AST+212+4H*CSC+12)	ZIV	758	
		WRITE (3, II72) KS, A, IMIN, IMAX, IS, IMIN, IMAX, IS	ZZ	759	
	1172	F ORMAT (6X,3HUCT)	2 1 4 2	761	
0.0	7.04	* 4A*ASI*AZIZ*SA**OCSC**Z**II) /	MAIN	762	
		IF (IS.61.) 60 TU 475	MAIN	763	
		WRITE (3.1176) IS. IS. IS. ((LBPL.LBCT.KS.LBXSD.IS.KS) .KS=2.NSPC)	MAIN	164	
	1176	FORMAT (6X,4HSUM=,7HCI *XSTV, IZ,4H+XSD,2IZ,2(AI,AZ,IZ,A4,2IZ),AI,	Z	765	
.65	•		Z	100	
		WRITE(3,1180) IS.IS.IS.IS.(LBPL,LBCI,KS,LBUXSU.IS,KS,LBPL,LBUCI,	Z Z Z	161	
		* KS*[BXSD*]S*KS)*KS=K*NSFC) FSBX*1/4X, FBSSIM-, \$HIDT*Y-12, \$H+CT*CXTX, 12, \$H+DXSD, 212,	ZZ	692	
	1 180	FORMATIONSOND SOUTH # 011001 - 43   4   4   5   4   5   5   5   5   5   5	MAIN	770	
7.0	_	2 (42-12-45-212-41-43-12-44-212-41)	MAIN	171	
2		*RITE(3+476)1+1	MAIN	277	
	416	FORMAT (6X,2HZ (,12,1H, 12,9H)=CTM*SUM)	MAIN	773	
		WRITE (3.478) I.	Z Z	414	
	418	FORMAT(6X,2HDZ,1Z,1HS,1Z,1HS,1G,18H=DC:1M*SUM+C:1M*DSUM)	Z Z Z	27.6	
75	36.7	GU 10 420 TO 400 TO 480	Z Z	777	
		IT (IS-LI-MATC)	MAIN	778	
		WRITE (3,1180) IS, IS, IS, IS, ((LBPL, LBCT, KS, LBUXSD, KS, IS, LBPL, LBDCT,	MAIN	179	
	-	* KS.LBXSD.KS.IS) .KS=1,NM)	MAIN	780	
180		WRITE (3,476) I.		181	
		WRITE (3,478) I+1	ZZZ	787	
	007	60 10 490	Z A A	784	
		1-01-#01	MAIN	785	
.85		WRITE (3,1176) IS. IS. IS. ((LBPL, LBCT, KS, LBXSD, KS, IS), KS=1.1M).	MAIN	786.	
	7	* ((LBPL,LBCT,KS+LHXSU,IS+KS),KS=IP,NSPC)	ZIA	787	
	•	WRITE(3.11PO) IS.1S.1S.1S.1S.(LBPL.LBC1.KS.LBUXSU.KS.1S.LBPL.LHUCI.	Z Z 4 X	286	
		_	ZIV	790	-
000		# NO.LBXSU.104N3/4N3-174N3FC/ #8717F73.474N1.1	MAIN	791	
2		***ITE(30-478)101	MAIN	792	
	064	NTINUE	Z	702	
	) (2)	SOLVE FOR DIFF VELOCITIES AND ENERGY FLOX.	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	795	
56,	404	FORMATCHESA AND ENFROR FOR OFFICEION VELUCITIES AND ENFROY FLUX. )	MAIN	796	
			MAIN	197	
			MAIN	748	
		WHITE (3.500) NMT.NILL	MAI	661	

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14.17.09	800 802 803	808 805 807 808	809 810 811 812 813	815 816 817 818	820 821 822 823	824 826 827 828 829	831 831 832 833 834 835 835 835	8838 839 840 842 843 843	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
04/15/80	ZZZZZ SZZZ ZZZZZ ZZZZ	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	ZZZZZZ ZZZZZZZ ZZZZZZZZ ZZZZZZZ ZZZZZZZ	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	Z Z Z Z Z	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	M M M M M M M M M M M M M M M M M M M	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ
PRDGRAM LOADF 76/76 OPT=I RDUND=+-*/ IMACE FIN 4.8+498	500 FORMAT(6X,9HCALL DEC(,12,1H,,12,1IH,Z,1PS,1ER) )  DO 495 K=1,NSPC  WRITE(3,492)K,K,PHN  492 FORMAT(6X,2HN (,12,7H)=RH*DX,12,1H/,1PE14,6)	702	WRITE (3,512) IP  512 FORMAT (6X,2HV(*)12,5H)=0. WRITE (3,712) IP  712 FORMAT (6X,2HDV*)12,4H=0.0 515 CONTINUE  00 517 I=I*NSPC	215	520	522 722 525 525		530 CONTINUE 532 FORMAT(6X,2HV(,1Z DU 535 I=1,NSPC IF (DF (1), EQ.0,0)G IP=LD (1), +2*NSPC WRITE (3,532)IP,1 WRITE (3,532)IP,1 WRITE (3,532)IP,1 WRITE (3,532)IP,1	538 540 726
	900	805	810	815	820	825	830 835	840	845 850

	7.30	XKITE(3,728)X,K,K,K,K,K,PHN FODMAT(4X,3HDVT,1D,1EH=2,3,E(DXH*DT*2(+12)	Z	928	
		RH*DDT*V(*I2*]IH) +RH*DT*Dv(*I2*]0H)	MAIN	829	
		* /5X, IH*, IX, 9HDI/T)/(T*, IPEI4.6.1H) )	ZIV	860	
860	730	CONTINUE	Z Z	198	
		00 545 I=I+NSPC		200	
	į	WRITE (3,542) [9] 9] 9]		864	
	545	/HT 4214   4 - 424   4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 -	Z V	865	
L	245	CONTINUE 15 7.5 1=1. MSDC	MAN	866	
265		UO 745 1-1107C	MAIN	867	
	77.3	WK11E(50)42/1101V1V1V1V1V1V1V1V1V1VEDODDDDDDDDDDDDDDDDD	MAIN	868	
	1	CONTRACTOR (CONTRACTOR CONTRACTOR	MAIN	698	
	77.5	CONTINE	MAIN	870	
970	<b>.</b>	DO 550 I=I • NSPC	MAIN	871	
,		WRITE (3.5548) I. 1	ZIV	872	
	548	FORMAT (6X,94RHUV (IST+,12,7H)=RH*UV,12)	ZIV	873	
	550	CONTINUE	2 3	\$ C	
		00 750 I=I+NSPC	2 2 4 4	876	
875		_ 1	ZIV	877	
	748	FORMAT (6X+) UHURHUV(151++) Z+BB1/-URB*UV*1Z+VIX+RB*UV*1Z+ COMPTANIE	Z	878	
	020	CONTROL FROM CM***********************************	MAIN	879	
	,	0*PRFSS*1.9872/(4.0*82.05)	MAIN	880	
980			ZIVE	881	
		LBV=3H*V(	MAIN	882	
		- 11	Z Z	883	
		(3,556) ((LBPL,LBX,K,LBV,K+NSPC,LBP),K=I,NSPC)	2 2 2	984	
	526	ORMAT		288	
885		• (	Z	887	
		XOX	MAIN	888	
		WRITE (3,756) ( (LBPL,LBDX,K,LBV,K+NSPC,LBP,LBPL,LBX,K,LBDV,	MAIN	889	
		* K+NSPC+LBP) *K=1*NSPC)	NAM	890	
068	156	FORMAT (6X,5HDSUM=,2(AI,A2,I2,A3,I2,3AI,I2,A4,I2,AI),AI,	Z I V	891	
		X.IH*.3(A2.I2.A3.I2.3AI.I2.A4	Z	268	
		WRITE (3,557) LBTRS.A	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	200	
	557	FORMAT (6X, A5, IH=, IPE 14.6,6H*SUM/I)	2 2	# C C	
		LBDTRS=6HDRLTRS		200	
895	ļ	WRITE (3-757) LBU-RS-A	Z	897	
	/در	1 7 1 7 1 0 1 1 0 2 1 0 2 0 1 1 0 1 1 1 1 1 1 1	MATA	898	
		CBIN =5APLIN	MAIN	668	
		15 (55 (1) 50.0.0) G() 10 553	MAIN	006	
000			MAIN	106	
		(C) (C) = I	MAIN	905	
	553	CONTINUE	MAIN	903	
			ZIV	706	
		IF (NT.EU.0) GO TO 554	MAN	202	
506		-	2 7 4 2	206	
		3. (56) (([BFL:CDDA*[DV:N]*L***********************************	2 Z	806	
		• -	MAIN	606	
		T=6HDRLINT		910	
016			NAIN	116	
	554	Z	MAIN	_	
		WKITE (3,542)	ZIV	913	

18	
PAGE	
14.17.09	971 972 973 975 975 976 977 979 980
04/15/80 14.17.09	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ
FIN 4.8+498	K*LBP) *K=1*NSPC) *LBP :I2*AB*I2*AI) *2A1* )*TX) /CM(IC) )
OPT=I ROUND=+-#/ THACE	LBH=BH)*H(IST+ WRITE(3.672)TMSTP,((LBBL.LBPL.LHM.K.LBH.K.LBP).K=1.NSPC).LBP FORMAT(6X.4HTR=1PE20.10.2H*(.2(ZAI.AZ.IZ.AB.IZ.AI).ZAI.  * 9(/5X.1H*.IX.2(AZ.1Z.AB.IZ.3AI)) * 9(/5X.1H*.IX.2) * 9(/5X.1H*.IX.2) * 9(/5X.1H*.IX.2) * 9(/5X.3HTR=1X.AIX.AIX.AIX.AIX.AIX.AIX.AIX.AIX.AIX.AI
16/76	LBH=BH)*H(IST+ WRITE(3.672)TMSTE FORMAT(6X.4HTR= 9 (/5X.1H*.1X.2(A) 9 (/5X.1H*.1X.2(A) A=-TMN/(TPN*PHN) WRITE(3.674)A FORMAT(6X.3HTX= FORMAT(6X.3HFVAI) FORMAT(6X.3HFVAI) STOP
PROGRAM LOADF	676 676 676

_								
14.17.09	NM	110000	10 9 8 11 10 9 8	16 16 17	18 20 22 23	287 287 287 287	33 3 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	37 37 39
04/15/80	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	3 2 2 2 0 0 0 0 0 0	000000	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2 2 2 2 2 2	9 9 9 9 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
76/76 OPT=1 KOUND=+~*/ THACE FIN 4.8+49H	SUBROUTINE DR(NSPC*NMT*NDIM) FIND THE DERIVATIVES OF THE SOLUTIOMS V.	LRSP=IHS LBM=]H- LBV=3H*V(	1=1 NTOP=2*NSPC WRITE (3,10)1,1, ((LBM,LBDZ,1,LBSP,J,LBV,J,LBP),J=2,NTOP) FORMAT(6x,3HDV(,12,4H)=DV,12,3(41,A2,12,A1,12,A3,12,A1),AI, * 7(/5x,1H*,1X,4(A2,12,A1,12,A3,12,2A1))	NM=NSPC-1 DO 15 1=2.NM 1M=1-1 1P=1-1 NST=NSPC+1	WRITE (3.10) 1, 1, ((LBM,LBDZ,),LBSP,J,LBV,J,LBP),J=1,1M),  ((LBM,LBDZ,),LBSP,J,LBV,J,LBP),J=1P,NSPC),  ((LBM,LBDZ,),LBSP,J,LBV,J,LBP),J=NST,NIOP)  CONTINUE  1=NSPC	WRITE(3,10)1,1,(LBM,LBDZ,1,LBSP,J,LBV,J,LBP),J=1,NM),  (LBM,LBDZ,1,LBSP,J,LBV,J,LBP),J=NST,NTOP)  DO 25 1=1,NSPC  IP=I+NSPC  WRITE(3,10)1P,1P,((LBM,LBDZ,IP,LHSP,J,LBV,J,LBP),J=1,NMT)  CONTINUE	110P=NMI-2,0*NSPC 50 30 1=1,110P IP=1,2*NSPC *R1TE (3,10) IP,1P,((LHM,LBDZ,1P,LMSP,J,LHV,J,LHP),J=NST,NTOP), * LHM,LBDZ,IP,LBSP,1P,LBV	WRITE(3,32)NMT,NDIM FORMAT(6X,9HCALL SOL(*12,1H**12*10H*Z,DV*1PS) ) RETURN END
INE DR	C		10		15	25	30	32
SUBROUTINE DR	-	છ	10	15	20	25	30	35

PAGE			,						
14.18.13.	LCM LENGTH								
04/15/80	*								
1.0 0	25140								
VERSION	167н				CNST H2 H2 H2	0 0 0 2 Z Z	•		
LOADER	SCM LENGTH				36945345E-14 58099162E-05	23555E 40102E	CONDUCTIVITY	• * 1	
					-10 -02	00-	VISCUSITY	v1SC0S1T	
	241)	FILE L60 LG0 SL-FINLIB SL-FINLIB SL-FINLIB	SC + TNL 18	SL-F TNL 18	38.00 0. -34909973E -26765200E -22997056E	•	1 1 1	2 N 2	
A G	ADF ( 8	I	4 SL+ 10 SL+ 110 SL+ 1156 SL+ 1156 SL+ 45 SL+ 45 SL+ 144 SL+ 173 SL+ 144 SL+ 174 SL+		2 54421 57445 89047	3.06 235277E- 748261E+ 611588E+	6.502900E-0	6.613600E-0.	
2 L 0 A D	ED AT LO		20275 20311 20311 20351 20352 21050 21447 22014 22070	23125 23125 23125 23126 24162 24173 24173 24711 24711 24711 25012 25020 25022	2.00 2.464E-03 .461E+01 .739E-11	54866E-02 15148E+01 77253E-12	2.188700E-06 6.357900E-06	4.26670UE-06	
SCOPE	1LL BE	BLOCK LOADF DR /STP.END/ /FCL.C./	Q2NTRY= COMIO= FECMSK= FELFST= FLTIUN= FLTOUT= FMTAP= FORSYS= FORUTL= GETFIT= INPC=	KRAKER= CUTC= OUTCOM= SPA= ERRCAP= FERCAP= FERCAP= ACOSIN• EXP•MSG SQRT• SQRT• SYSAID= SYSAID=	+03 +03 -08	E+01 E+03 E-09	5 Z	S N	
	PROGRAM			73	.310018 87738 .55210	.28963 90586 63217	<b>-</b>	~	

~ ~	H H2	2 Z	m un	119300E	-04	1.119300E-04 1.661400E+00 5.951700E-05 1.663800E+00	JUE+00	H2 H2	S S	HINARY L	BINARY UIFFUSION.
Q.	N N	N/N/N/N/N/N/N/N/N/N/N/N/N/N/N/N/N/N/N/	prof.	537400E	-05	1.537400E-US 1.67290UE+00	JUE +00	N	N2	HINARY L	HINARY UIFFUSION.
PRESS = 1.00 IPN = 1.0000E	E+03	PHN	5.000	5.0000E-05		TMN = 1	TMN = 1.0000E-03	<b>m</b>			
1.088500E+00	9.0557	9.055700E-03	A* HCB		T A*	FIT A*TS**B					
1.078600E+00		8.500100E-02 B* HCB	B* H	CB FIT		A*EXP(C/T)					
0 542600F = 01	07367 (-	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1			- F. O. O. O.					

SUBROUTINE F(TIME, PH+U, UPH2, FVAL, NPUE, KPUE, IC, KSKT, KSKR) F UIMENSION Z(30, 30) + IPS(30) DIMENSION Z(30) + UPH2, INDEX,	, TMSPH2, TMSTP, TPENT	(100)	or one pue is returneo in FVAL.	MALL. TRANSPORT WARNATZ PAR. 10NS / MOLECULAR WEIGHTS.		F (T.GT.1000.)GO TO 2000   C  = I.9872*( 3.05744510E+00+T*( 2.67652000E-03   * +T*( -5.80991620E-06+T*( 5.52103910E-09+T*( -1.81227390E-I2))))   OC  = I.9872*( 2.67652000E-03+T*( -I.16198324E-05	* +T*( 1.65631173E-08+T*( -7.24909S60E-12)))*01 H 1=1.9872*( -9.88904740E+02+T*( 3.05744510E+00 * +T*( 2.676S2000E-03/2.0+T*( -5.80991620E-06/3.0 * +T*( S.52103910E-09/4.0+T*( -1.81227390E-12/5.0)))) C 2=1.9872*( 3.67482610E+00+T*( -1.20815000E-03 * +T*( 2.32401020E-06+T*( -6.32175S90E-10+T*( -2.25772S30E-13)))) F		.69453450E-15))))		* +1*( -5.723S2770E-U7+T*( 9.98"/3930E-11*T*( -6.S223S550E-15))))} F UC 2=1.9872*( 1.51548660E-03+T*( -1.14470554E-06 * +T*( 2.99422179E-10+T*( -2.50**4220E-14)))*UT
	v	10	15	50	52	30	3.5°	0 7	8 4 S	0 S	\$5

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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        TMN = 1.0000E-03
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        DX I=DY 1/YS-Y 1*DYSY
DDX I=(DDY 1-2.0*DY 1*DYS/YS+Z.0*Y 1*DYSYSU-Y 1*DDYS/YS)/YS
CSZR I= 3.571428571429E-03
           * +1*( 1.51548660E-03/2.0+1*( -5.72352770E-07/3.0
* +1*( 9.98073930E-11/4.0+1*( -6.52235550E-15/5.0)))))
Z=1.9872*( -9.05861840E+02+T*( Z.89631940E+00
                                                                                                                                                                                                                                                                       ST PAR.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    DPH=- 1.218769043266E-02*(DT/T+UYS/YS)/(T*YS)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                DCSC 1=(DCSZR 1-CSZR 1*DCINT 1/CINT 1)/CINT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       CINT 1=C(1ST+ 1)* 1.006441223833E+00-2.5
                                                                                                                                                                                     THERMAL CONDUCTIVITIES FROM WARNATZ ST PAR.
                                                                                                                                                                                                                                                                    BINARY DIFFUSION COEFFICIENTS FROM WARNATZ
                                                                                                                                                                                                                                                                                                            U 1 1= 1,119300E-04*(T** 1,661400E+00)
D 1 2= 5,951700E-05*(T** 1,663800E+00)
D 2 2= 1,537400E-05*(T** 1,672900E+00)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                CZ 1 1=1.0+ 1.051032953946E+00*(CSZH 1)
                                                                                                                                                                                                              V 1= 2.188700E-06*(1** 6.502900E-01)
V 2= 4.266700E-06*(1** 6.613600E-01)
RL 1= 6.357900E-06*(1** 7.383300E-01)
RL 2= 6.407700E-07*(1** 7.999600E-01)
                                                                                                                                                                                                                                                                                                                                                    DEFINE USEFUL COMBINATIONS AND DERIVATIVES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     DCINT 1=DC(1ST+ 1)* 1.006441223x33E+00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           DCZ 1 1= 1.061032953946E+00*(UCSZR 1)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       5.0000E-05
                                                   SPECIFIC HEATS AND SPECIFIC ENTHALPIES.
C(1ST+ 1)=C 1/ 2.00
                                                                                                                                                                                                     LEAST SQUARES FIT, T=300,2000.
                                                                                                                                                                           LEAST SQUARES F17, T=300,2000.
                                                                                                                                                                                                                                                                                   LEAST SQUARES FIT, T=300,2000.
                                                                                                                                                           VISCUSITY FROM WARNATZ ST PAR.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        ≡ NHd
                                                                           DC(1ST+ 1)=DC 1/ 2.00
H(1ST+ 1)=H 1/ 2.00
C(1ST+ 2)=C 2/ 28.00
                                                                                                                    DC(1ST+ 2)=DC 2/ 28.00
                                                                                                                               H(1ST+ 2)=H 2/ 28.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              2=0Y 2/YS-Y 2*UYSY
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   CSC 1=CSZR 1/CINT 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                0YS=+0Y 1+0Y 2
00Y 1=00U 1/ 2.00
00Y 2=00U 2/ 28.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              DYSYS0= (DYS/YS) **2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          DDYS=+DDY 1+DDY 2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      DY 1=DU 1/ 2.00
DY 2=DU 2/ 28.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                DYSY=DYS/ (YS*YS)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       = 1.0000E + 03
                                                                                                                                                                                                                                                                                                                                                                                                                                    00U 1=UPH2( 1)
                                                                                                                                                                                                                                                                                                                                                                                                                      00 1=UPH( 1)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                         DDU 2=-00U 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  UCSZR 1=0.0
                                                                                                                                                                                                                                                                                               1.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                 U 2=1.0-U 1
                                                                                                                                                                                                                                                                                                                                                                                X 1=Y 1/YS
                                                                                                                                                                                                                                                                                                                                                                                            X 2=Y 2/YS
                                                                                                                                                                                                                                                                                                                                                                                                                                                              DU 2=-DU 1
                                                                                                                                                                                                                                                                                                                                                                                                         0 1=0(1)
                                      CDNT I NUE
                                                                                                                                               CDNT INUE
                                                                                                                                                                                                                                                                                                                                                                   YS=Y 3
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C SP
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04/15/80	L L L		L L L L	<u>. L. I. L. L. </u>	عاداد اد اد اد	الدائد الدائد ا	اساند اند اند اند ا	د اید اید اید ا	<u>. L. L. L. L. L</u>	_ 12_ 12_ 12_ 12_ 12_	LE LE LE LE	<b>Le 12 Le 12 1</b> 2 12	
76/76 OPT=1 KOUND=+-#/ THACE FIN 4.8+498	DUX 2=(DDY 2-2.0*UY 2*DYS/YS+2.0*Y 2*UYSYSQ-Y 2*UDYS/YS)/YS CSZR 2= 6.36426751592E-02* 1.751045651893E+00/	* SURT (1)* 3.4836726733136.0171 0CSZR 2=-( 8.755228259466E-01/SuRT(T)* 3.483292299373E+01/T)*0T/T CZ 2 2=1.0* 1.061032953946E+00*(CSZR 2) 0CZ 2 2= 1.061032953946E+00*(UCSZR 2) 0.007 2 2.00713734546F+01-2.5	CINI	1+x 1+0 1552756 4320557	UXSD 1 = DX 1 1 = VD 1 1 + X 1 1 + UVU 1 1 X 1 2 = X 1 + X 2	1 (CS 5ZR	UX 2 2=DX 2*X 2+X 2+UX 2 VU 2 2 = 6.504488096787E+04+(T*+( -1.672900E+00)) DVD 2 2 = -1.088135813711E+05*(T**( -2.672900E+00))*DT XSU 2 2=X 2 2*VD 2 2 UXSD 2 2=UX 2 2*VU 2 2+X 2 2*DVU 2 2	SXSD I=+X 2*VD 1 2 USXSD I=+DX 2*VD 1 2+X 2*DVD 1 2 SXSD 2=+X 1*VD 1 2+X 3*VD 2 3 DSXSD 2=+DX 1*VU 1 2+X 1*DVD 1 2+DX 3*VU 2 3+X 3*DVD 2 3 SXSD 2=+DX 1*VU 1 2+X 1*DVD 1 2+DX 3*VU 2 3+X 3*DVD 2 3	DSXSD 2=+DX 1*VD 1 2+X 1*DVD 1 2 STV 1= 4.568922191255E+05*(T**( -1.650290E+0U)) USTV 1= -7.540046603006E+05*(T**( -2.650290E+0O))*DT XSTV 1=X 1 1*STV 1 UXSTV 1=DX 1 1*STV 1+X 1 1*DSTV 1	STV 2= 2,343731689596E+05*(1**( -1,661360E+00)) USTV 2= -3,893782079828E+05*(1**( -2,661360E+00))*DT XSTV 2=X 2 2*STV 2 UXSTV 2=DX 2 2*STV 2+X 2 2*DSTV 2 SPECIFIC HEAT OF THE MIXTURE. NTIS FORMULA.	CM(IC)=+C(ISI+ I)*O I+C(ISI+ E)*C E UIFFUSION AND HEAT FLUX. SEE DIXON-LEWIS. II. TRANSPORT PHENOMENA IN MULTICOMPONENT SYSTEMS. LM U0+00	50 1 2+ 50 1 2+ 50 1 2+ 50 1 2+ 50 1 2+	14 A4 B4 AND C
SUBROUTINE F		-								U	0300		S
SU	115	120		125	130	135	140	145	150	155	160	165	•

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FTN 4.8+498

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5.4777777777778E+00= 2.61.33333333E+00*HST 1 2+CT 2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  2,488888488889E-01*(UASI 1 2*C2 1 2+AST 1 2*DC2 1
                   AST 1 2= 1.088500E+U0*(TS**( 9.055700E-03))
DAST 1 2= 9.857129450000E-03*UTS*(TS**(-9.909443E-01))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        UCT 2=- 2,61333333333E+00*DBSI 1 2+UCT 2
                                                                                                                      CT= -1.666666666667E-01*(1.2*CST 1 2-1.0)
                                                                                                                                                                    2-1.0)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        CT 2= 2.48888888888888 -01 *AST 1 2*C2 1 2
                                                    BST 1 2= 1.078600E+00*EX
DBST 1 2= -9.168208E-02*DTS*EX/(TS*TS)
EX=EXP( -1.435700E-01/TS)
                                                                                                 DCST 1 2= 1,370031E-01*DTS*EX/(TS*TS)
00,10 AND LM 10,00
                                                                                                                                           Z( 1, 4)=CT*XSD 1 2
DZ 1S 4=CT*DXSD 1 2+DCT*XSD 1 2
CT= -2,3333333333E+00*(1,2*CST 1
DCT= -2,8000000000000E+00*CST 1 2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             UCT= -4.062563477554t-02*UCZ 1 1
                                                                                                                                  DCT= -2.000000000000L-01*DCST 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    2( 3, 3)=CT*XSTV 1-X5U 1 2*CT 2
                                                                                                                                                                                       2( 2, 3) =CT*XSD 1 2
DZ 2S 3=CT*DXSD 1 2+UCT*XSD 1
Z( 1, 3) =-Z( 2, 3)
DZ 1S 3=-DZ 2S 3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  CT= -4.062563477554E-02*CZ 1 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            35 4=CT*DXSD 1 2+UCT*XSD 1
                                                                                                                                                                                                                                  25 4)=-Z(1, 4)-Z(3, 4)
25 4=-DZ 15 4-DZ 35 4
25 4=-DZ 15 4
25 4=-DZ 15 4
35 1)=Z(1, 3)
35 1=Z(1, 3)
35 2=Z(2, 3)
37 2=Z(2, 3)
                                                                                       CST 1 2= 9.542600E-01*EX
                                           8.500100E-02/TS)
          6.086871E+01
6.086871E+01
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          * +DAST 1 2*CZ 1 2))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    Z( 3, 4)=CT*XSD 1 2
                                                                                                                                                                                                                                                                                                                                                                       01.00 AND LM 00.01
                                                                                                                                                                                                                                                                                                                            (+ +)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 Z( 4. 3)=Z( 3. 4)
                                                                                                                                                                                                                                                                                                                                                 2)=Z( 2, 4
2=DZ 2S 4
                                                                                                                                                                                                                                                                                                                                       1=DZ 15 4
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     9 56 70=6 54 20
                                                                                                                                                                                                                                                                                                                                                                                   1)=0.0
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                                                                                                                                                                                                                                                                                                                                                                                                                            5)=0.0
                                                                                                                                                                                                                                                                                                                                                                                                                                        6)=0.0
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DOZ 3S 3  CT = -5.  DOT 1 = -5.  DOT 1 = -6.  DOT 1 = -6.  DOT 1 = -6.  CT 1 = -6.  CT 2 4.  CT 2 4.  CT 3 6.  CT 3 6.  CT 4 6.  CT 2 6.  CT 3 6.  CT 3 6.  CT 4 6.  CT 6 6.  CT 1 = -6.  CT 2 6.  CT 3 6.  CT 1 = -6.  CT 2 6.  CT 3 6.  CT 3 6.  CT 4 6.  CT 4 6.  CT 1 = -6.  CT 2 6.  CT 1 = -6.  CT 2 6.  CT 3 6.  CT 3 6.  CT 4 6.  CT 1 = -6.  CT 2 6.  CT 3 6.  CT 4 6.  CT 2 6.  CT 4 6.  CT 2 6.  CT 3 6.  CT 4 6.  CT 6 6.  CT 8 6.  CT	14.18.	230 231 232	233 234 236 236	238 239 240	25 4 4 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	50 6 6 4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	252 253 254 254	258 258 259 260	262 263 264 265 265	269 269 270	272 273 274 275	277 278 278 279 280	28 <b>2</b> 28 <b>3</b> 284 285	200
D2 35 3CTFOXSTY 1.0CT*XSTY 1.0CT*XSTY 1.2S 0 1 2*CT 2*XS 0 1 2*DCT 2  CT = 5.68788885764-01*CZ 2 2  CT = 2.48888888956-01*CZ 2 2  CT = 2.4888888956-01*CZ 2 2  CT = 2.4988888956-01*CZ 2 2  CT = 2.48888898956-01*CZ 2 2  CT = 2.488888898956-01*CZ 2 2  CT = 2.48888898956-01*CZ 2 2  CT = 2.488888989696-01*CZ 2 2  CT = 2.4888898969696-01*CZ 2 2  CT = 2.4888896969696-01*CZ 2 2  CT = 2.48889696969696-01*CZ 2 2  CT = 2.488869696969696-01*CZ 2 2  CT = 2.48886696969696-01*CZ 2 2  CT = 2.48886669696	04/15/80	12.12.12.1	<u>. 1. 1. 1. 1</u>		ie l <u>e le</u> le le i	. L. L. L. L. L. I	<b>. i. i. i. i.</b> i	لد لد لد لد له ا	. L. L. L. L.		بايد اعد اعد اعد اد	اسلام است	ـ ښاي ند له ن	L
SUBROUTINE	OPT=1 ROUND=+-*/ THACE FIN	*DCT	*DCZ 1	2(4, 4)=CT*XSTV 2-X5D 1 2*CT 1 02 45 4=CT*DXSTV 2+UCT*XSTV 2-DX5D 1 2*CT 1-X5D 1 10*01 AND LM 01*10	2+AST 1 2*DCSC 2 1+AST 1 2*DCSC 1		SC 1+AST 1 2*DCSC D 1 2+DCT 2*XSD 1	2.970892271049E+00*AST 1 2*CSC 2 2.970892271049E+00*(DAST 1 2*CSC 2+AST 1 2*DCSC 2-970892271049E+00*(DAST 1 2*CSC 2+AST 1 2*DCSC 2-970892271049E+00*(DAST 1 2*CSC 2+AST 1 2*DCSC 2-970892271049E+00*(DAST 1 2*DCSC 1 1*XSD 1 2+DCT 1*XSD 1 1=7(3*5)	1 = 0 Z 3 = 0 Z 4	2(6, 4)=2(4, DZ 6S 4=DZ 4S 6 01,01 2(5, 6)=0,0 2(6, 5)=0,0	1 2*650 1	1 2*CSC 1*AST 1 2*DCSC 1) 2 1+CT 2*DXSD 1 2+DCT 2*XSD 1	2/(CINT 2*CINT /) 500c-01*CSC 2 H500c-01*UCSC 2 52I2I7578E+01*A-1 1 2*CSC 2	OCT I= 1.0695212175/8E+01*(DAST 1 2*CSC 2+AST 1 2*UC\$C 2)
230 240 255 255 255 260 275 275 275	SUBROUTINE F	230	ų,		240	245	250	255	260	265 C	270	275	280	285

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14.18.15	344	345	346	347	34.8	349	350	351	100	200	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	010		381	382	383	384	385	386	387	388	386	390	202	393	
04/15/80	L	L	. 14.	. 14.	. L	. 14.	. L	. u		<b>.</b> (	<b>-</b> 1		Ŀ	L.	LL.	L	14.	. <b>L</b> L	L	u.	<b>L</b>	Ŀ	Ŀ	LL.	<b>L</b> L	L.	L.	<b>L</b>	<b>L</b> . 1	LL.	<b>L</b> 1	<b>L</b>	L.	<b>L</b>	<b>.</b> l	_ L	. u	. <b>L</b>	. L	. LL	L	. <b>Ļ</b> L	L	LE.	<b>L</b> (	L. L	L L	<b>. L</b>	_ 14.	
F 76/76 OPT=1 HOUND=+-*/ THACE FIN 4.8+498	(201-70-7-06-3) (201-70-7-06-3)	CALL SULL 00-500-5.00-5.00-5.00-5.00-5.00-5.00-5.		10000000000000000000000000000000000000	UDITEDERS (NEDE) * 1. * OCCOMPANCE TO TABLED TABLE TO TABLED TABL		+ D1/T1/(1* 5.000000E-05)	1 A	* DT/T)/(T* 5.000000E-05)	UV 1=U 1*(VX 1+VT 1)	UV 2=U 2*(VX 2+VT 2)		0.13 2=0.1 2 (VX 2+VI 2)+U 2* (DVX 2+DVI 2)		1	MINOVICE - 11-DUMPIN 1+DH#DIIV 1	ACCURATION TO THE PROPERTY OF	• 00	(† ) ACI+C X + († ) A+A X CI+C I ACI+C X + († ) ACI+C X (	1		CIMERA 1472 614 247 ( 7)	DOMESTAL   TAVE   TAV			UKLIN - 1-515/11C - 1-500: 00: 00: 00: 00: 00: 00: 00: 00: 00:	INT IND THE TOTAL	Z   Z   C   C   C   Z   C   Z   C   Z   C   Z   C   Z   C   Z   C   Z   C   Z   C   Z   Z	CATE A (1C) = DAH + RIN + BH + DRIM		0.50M = +0.0X + 4.0(-1) +0.0X + 1.40V(-1) +0.0X + 2.4(-2) +0.0X +2.40V(-2)	0X= -1.210968921389E+03*RH*SUM	DOX (1C) = 1.210968921389E+03*(UPH*SUM+RH*DSUM)	C FIND THE TIME DERIVATIVES.	S	100 CONTINUE	IF (KPDE.EQ.NPDE) GO TO 150	RY= 1.000000000E-03*R(RPUE)		T VAL		150 CONTINUE	( GOAN) AHADA (OI) M HAH ( ALAMA HADA ( OI) M HADA (	TI)=- 2_00000000000E+01*UPH(NPUE)*( +C(1ST+ 1)*RHUV(1ST+ 1) +	2) *RHUV (IST+ 2) )	TH=- 1.0000000000E-06*( +R( 1)*H(IST+ 1) +R( 2)*H(IST+ 2))	Tx= -2.00000000000000E-02*DQX(1C)	FVAL=SP*UPH(NPUE) + (1L+TR+TD+TX)/CM(IC)	RETURN	r NO
SUBROUTINE				345					350	,				LI C	355					360					365				370					375					380					Chi				390		

	PROGRAM LOADF 76/76 OPT=1 KOUND=+-*/ 1HACE FIN 4.8+498	04/15/80	04/15/80 14.21.28
-	PROGRAM LOADF (IMPUT.OUTPUT.TAPE5=IMPUT.TAPE6=UUTPUT.	MAIN	2
	* TAPE3.TAPE9.TAPE15)	MAIN	٣
	C LOADF CREATES THE SUBROUTINE F IN FLSC.	MAIN	4
	DIMENSION II (72)	MAIAM	Ŋ
ď	U1MENSION 18(25) *W (25) *AU (7*25) *AL (7*25)	MAIN	9
)	DIMENSION ALO(25) + 8LU (25) + ABD (25+25) + BBD (25+25)	MAIN	7
	DIMENSION LAPR(25)	MAIN	8
		MAIN	٥
	DIMENSION LBROT (25) + SGA (25) + ESK (25) + UM (25) + ALP (25) + ZROT (25) + DF (25)	S) MAIN	10
10	DIMENSION AV (25) + 6v (25)	MAIN	11
,	VKI TE (3 * 1000)	MAIN	12
	1000 FORMAT(1HC. 2x. 34 HWE WANT TO AVOID DIVISION BY ZERO. )	MAIN	13
		MAIN	14
	10.12 FURMAT (6X, 14HOO 5 K=1. NPOEM)	MAIN	15
15		MAIN	16
	10.14 + FORMAT(6x, 32HIF(ABS(U(K)), LT.SMALL)U(K) = SMALL	MAIN	17
		MAIN	18
	10.16 FORMAT(11X, 1H5, 4X, 36HIF (ABS (UPH(K)), LT, SMALL) UPH(K) = SMALL )	MAIN	19
		MAIN	20
50		MAIN	21
	C NLINE IS THE NUMBER OF COMMENT LINES TO BE READ AND PRINTED.	MAIN	22
	00 20 K=1.NLINE	MAIN	23
	REA0(5, 22) I I	MAIN	54
	WRITE (3,22) II	MAIN	52
25	20 CONTINUE	MAIN	56
	22 FOHMAT (72A1)	MAIN	27
	24 FURMAT (/1x+72A1/)	MAIN	28
	REAO(5.12) NSPC	MAIN	59

MAIN 29			MAIN 32		MAIN 34		MAIN 36						MAIN 43		MAIN 45							MAIN 52	MAIN 53	MAIN 54	MAIN 55	MAIN 56	MAIN 57	MAIN 58
REAO(5•12)NSPC	NM=NSPC-1	L8M≈1H-	LBU=2HU (	LBP=1H)	WRITE (3,1020) ((LBM,LBU,K,LBP),K=I,NM)	1020 FORMAT(6X,6HYN=1,0,8(A1,A2,I2,A1),A1,2(/5X,1H*,1X,	*	WRITE(3+1025)	1025 FURMAT(6X, 33HCALL RI(U, YN, R, NPDE, KPDE, IC, KSKR) )	18 FORMAT(6X,4HIST=,12,7H*(IC-1))	C ASSUME AT MOST ONE POLAK SPECIES. (OIPOLE MUMENT NON-ZERO).	C THEN A* AND B* CAN BE APPROXIMATED BY LENNARU-JONES COLLISION	C INTEGRALS. EVEN IF THE INPUT PARAMETERS ARE STOCKMAYER.	DO 30 K=1.0NSPC	READ(5,32) LB(K), w(K), OF(K), SGA(K), ESK(K), UM(K), ALP(K), 2ROT(K),	* LBR01(K)	WRITE (6,34) K.L.B.(K) .W (K) .OF (K) . SGA (K) .ESK (K) .UM (K) .ALP (K) .ZROT (K) .	* LBR01(K)	REAO(15,36) (AU(L,K),L=1,5), (III(L),L=1,5)	WHITE $(6,36)$ (AU(L+K)+L=I+5)+(III(L)+L=I+5)	HEAD (15,36) (AU (L,K),L=6,7) . (AL (L,K),L=1,3) . (111 (L),L=1,5)	WKITE (6,36) (AU(L,K),L=6,7), (AL(L,K),L=1,3), (III(L),L=1,5)	READ(15, 37) (AL (L, K), -=4, 7), (III (L), -L=1, 20)	WHITE(6,37)(AL(L,K),L=4,7),(111(L),L=1,20)	30 CONTINUE	32 F URMAT (AS, 7FT, 0, AS)	34 F ORMAT (/2x,14,4x,45,4x,7F8,2,4x,45/)	36 FURMAT(SE15.8.5AI)

0 4

	PROGRAM LOADF 76/76 OPT=1 ROUND=+-*/ THACE FIN 4.8+498	04/15/80	14.21.28
		MAIN	65
	37 F OKMAI (4E15:80×CM1) OF ARY (4E12)	MAIN	60
		MAIN	61
9	( ( ( ( ) ) )   ( ) ( )   ( ) ( )   ( ) ( )	MAIN	62
	27 FURMAT (6x*22HIF (KSKT*6T*1) GO TO 100)	MAIN	63
	WRITE (3.28)	Z Z	4 0 4
	28 FURMAT(6X*22HIF(KSKK*6T*1)60 T0 125 )	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	6 4
65	READ(5,12)NLINE		2,4
	00 40 K=1.NLINE	N	<b>a</b>
	READ(5,22) II	ZEW	69
		MAIN	70
í	*	MAIN	7.1
7.0	* 1	MAIN	72
	C TO LINE TION TOWN OFF TOWN	MAIN	73
		MAIN	14
	42 FORMAT (6%, 24HIF (1.61.1000.) GO TO 2000)	MAIN	75
75		ZIV	9.
1	WRITE (3+52) K+AL (1+K) +AL (2+K)	ZIA	
	WRITE(3,54)(AL(L,K),L=3,5)	Z	0 C
	WRITE (3,62)K+AL (6,K)+AL (1,K)	2 2 4 4 2 2	, a
	WR1TE(3,64)AL(2,K),AL(3,K)	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	0 6
90		NEW	4 (
		Z	9 60
	52 FORMAT(6x, IHC, IZ, 94=1,948 [2*(), IFE [50, 844+1+1], 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	ZYW	9 6
		MAIN	95
		MAIN	86
<b>8</b> 2	DO TOTAL TOTAL DESCRIPTION OF SECULAR PROPERTY (2.50)	MAIN	87
	SA FORMAT (4H2000-2X BHCONTINUE)	MAIN	88
		MAIN	68
	WRITE (3.52) K.AU (1.K.) - AU (2.K.)	MAIN	06
06	WRITE(3,54) (AU(L+K)+L=3+5)	ZIV	91
	WRITE(3,62)K•AU(6*K)•AU(1•K)	NAN	26
	WRITE(3,64)AU(2,K),AU(3,K)	2 4 4 5	5 6
	WRITE (3,66) AU(4,K) + AU(5,K)	2 2 4 4 5	<b>3</b> C
		2 2 4 5	6 90
98	62 FORMAT(6X*1HH*1Z*9H=1.98/72*(*1PE16*844H*1*4*)*PE16*8)	ZIV	20
	FORMAT (5X*1H**1X*4H*)*(*1PE16*8*4HXX*U*4H*)*(*1PE1	Z	86
		MAN	66
	1 4 4 4 5 0 5 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	MAIN	100
	A FORDMAT (4H 2000 - 2X - H CONTINUE)	MAIN	101
001	WRITE (3-134)	MAIN	102
	134 FURMAT (IHC. 2X. 39HSPECIFIC HEATS AND SPECIFIC ENTHALPIES. )	MAIN	103
		2 2 2	105
	WRITE (3.142) X.X.Y.X(X)	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	105
105		ZZ	107
		MAIN	108
	142 FORMAT (6X.6HC(131**12*37)=C*12*17*10*2*17*10*2*17*10*2*17*10*2*17*10*2*17*10*2*17*10*2*17*10*2*1	MAIN	109
		MAIN	110
110		MAIN	111
		ZIVN	211 511
	C THERMAL CONDUCTIVITIES AND BINARY WIFFUSION COEFFICIENTS.	ZIAM	114
	C READ IN VISCOSITY - HERMAL CONDUCTIVITY AND STRAIN CLIP COLORS	MALV	115
	CUEPFICIENTS FROM A FILE CREATED OF VALUES.	,	

PROGRAM LOAUF

115	****		MAIN	116
:	READIS. 12) NI INF	N INF	MATA	117
	100 72 K=1 NI INF		MAIN	8
	READ (5,2211	1110	MATA	110
	WRITE (3,22) II	22)11	MATA	120
130		5.5 / 1.1		100
150	TONI INOC	The state of the s	2 .	121
		FORMAL (INC. DAY, INV. IC. IN- ITEL4.00.50" (1x. 1) ITEL4.00 IN)	MAIN	771
	READ (5, 12) NLINE	SINCINE	ZIV	123
	00 70 K=1,NLINE	1. NLINE	MAIN	124
	READ (5.22) I I	2) I I	MAIN	125
125	WH1TE (3,22) II	22) I I	MAIN	126
	7.0 CONTINUE		MATA	127
		2002.	MATA	128
	DE AD (0.9			00.
	O A CARDY		2	129
	WKI IE (69	WKIIE(6,84)K*L8(K)*AV(K)*BV(K)*III	Z	130
130	READ (9,8)	READ(9,82) ALD(K), HLD(K), III	MAIN	131
	WR11E (6+	₩K]]E(6•84)K•L8(K)•ALD(K)•BLD(K)•]II	MAIN	132
			MATA	133
		02516 6.46411		200
	TITUTE TO SE	CONTROL TO COLLEGE AND COLLEGE		\$ L
11			Z	C\$ 1
135			2	136
	16 WRITE (3.	WKI IE (3 / 28) K + AV (K) + GV (K)	NAIN	137
	DC 90 K=1.NSPC	1. NSPC	MAIN	138
	WRITE (3)	WRITE(3,92)K,ALD(K), BLD(K)	MAIN	139
	90 CONTINUE		MAIN	140
140		FORMAT46X.2HR  .12.1H=.1PF]4.6.5.14 (T**.1PF]4.6.1H)	MATA	141
•		INICATOR AND		17.1
	MEMULIAN INC.		2	7 -
	00 100 K=1+NCINE	II + N L I NE	NAIN	143
	READ (5,22) 11	2)11	MAIN	144
		22) II	MAIN	145
145	100 CONTINUE		MAIN	146
			MAIN	147
	1 011 00		MATA	140
	200 T=1 011 00		MATE	0 7 1
	UE AD CO. B.			
0 1 1	SOLITION STATES		2 :	150
130		MAXILE 00.112/1.00/Call/1.00/Call/1.00/caac/1.00/call/1.	ZIAE	151
	IIO CONTINOE		NIAN	152
		F OKMAT (/ZX,14,4X,14,4X,44,4X,44,4X,1P2E14,6,44A1/)	ZIAM	153
		14)PRESS	MAIN	154
	114 FORMAT (FE	(0.5)	ZIAM	155
155	WRITE (3+)	WRITE (3,116) PRESS	MAIN	156
	WRITE (6.1		MAIN	157
	116 FORMAT(1)	FORMAT(1HC,2X,7HPRESS =+F6.2)	MAIN	158
	DO 120 I=1,NSPC	=1,NSPC	MAIN	159
	-00 120 J=	J=I •NSbC	MAIN	160
160	ABD(I+J)=	ABU (I, 1) = ABU (I, 1) / PKESS	MATA	161
	WRITE (3+1	WRITE (3-122) I. U. ABD (1-1) - BBD (1-1)	MAIN	162
	0		MATA	163
	. ^!	FORMAT (6X.1HD.212.1H=.1PE14.6.5H+(1++.1PF14.6.1H))	MAIN	164
	* * *		21 4	165
165	C SPACE DERIVATIVES	S S A L L	MATA	166
1	***********		MATA	167
	LRPL=1H+		MAIN	16.8
	WRITE (3.148)	448)	MATA	169
	148 FUHMAT (1H	FOHMAT (1HC.2X.1HHSPACE DERIVATIVES.)	MAIM	170
170			MATA	171
	WRITE (3.149) NS	5N (67	MATA	172
	1 1 1 1 1 1 1			J - 7

PRO	PROGRAM LOAOF	IF 75/76 OPT=1 ROUND=+-*/ THACE FIN 4.8+498	04/15/80	14.21.28	
	140	FORMAT (6X.4HYS=Y.12)	MAN	173	
	r	50 K=1 NSPC	MAIN	<b>3</b> L	
		WRITE (3+152) K+K	Z	175	
175	150	INUE	ZZ	177	
	152	FURMAT (6X, 1HX, 12, 2H=Y, 12, 3H/YS)	Z	178	
		60 K=1.NM	MAN	179	
		WRITE (3.162) K.K	MAM	180	
		FRITE(3.164)K.K	MAN	181	
081		FRITE (3, 166) K.K	MAIN	182	
	160	CONTINUE	MAIN	183	
	162	FORMAT (6X*) HU* IX*3H=U(* IX*1H)	MAIN	184	
	164	FOXMA	MAIN	185	
	166	CXMA	MAIN	186	
185		LBO-170 WDITE(3,170)NGPC.((LBM-LBU-K)*K=1*NM)	NAIN	187	
	173	FORMATICK 1HJ. 12.4H=1.0.8(A1.41.12). A1.2(/5x,1H*,1x,	MAIN	188	
	711	* B(A1.[2,A]) )	ZIA	189	
		LB0U=2HDU	MAN	061	
061		WRITE (3,174)NSPC. ((LBM.LB0U.K) .K=1.NM)	Z	191	
	174	FORMAT (6X.2HOU.12.1H=.8(A1.A2.12).A1.2(/5X.1H*.1X.	N A A	192	
		* R(A2, I2, A1)) )	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	195	
		L800U=3HDDU	MATA	195	
		WRITE(3,176)NSPC, ((LBM,LB00U,K),K=1,NM)	ZIVE	196	
195	176	FORMAT (6X, 3HDDU, I2, IH=, 8 (A1, A3, I2), A1, 2 (/ 3A, IH*, IX)	2 2	197	
		* 8(A3,I2,A1)) )	2 4 4	198	
		UO 180 K=1,NSPC	2 4	000	
		WRITE (3.182) K + K + W (K)	Z	200	
	180	CONTINUE	MATA	201	
200	182	FORMAT (6X,2HDY,12,3H=DU,12,1H/,16,2)	ZIV	202	
		L807=2H07	AM	203	
		WRITE (3-186) ((LBPL-LEUT-K)+K=1+NSFC)	MAIN	204	
	186		MAIN	205	
l.		TUX.PXRVVXXXV0UV	MAIN	206	
505		NET - AND -	NIAM	207	
	ć	#XI_E(69734) FN9FENVIEW	MAIN	208	
	2.34		MAIN	509	
		*RITE(3,226) TPN	ZIAN	210	
210	226	FORMAT (6X+13HDT=UPH (NPDE) *, IPE12.4)	ZZ	213	
,		WRITE (3+242) PSR		212	
	242	FURMAT (6X*5HORH=+*]PE]8*10*21H*(U1/1+U15/15)/(1*15)/	ZZ	214	
		#KITE (3-1202)	MAIN	215	
u .c	7021	7 OKEA   OK   1 OK   1 OK   OK   OK   OK   OK	MAIN	216	
612		TE (3.1704) K.X.X	MAIN	217	
	1204		Z Z	218	
	1	A=ALO(K) *BLO(K)	NAM	617	
		H=BLD(K)-1.0	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	221	
220		WRITE(3-1208)K-A-8	MA	222	
	1208		MAIN	223	
		・	MAIN	554	
		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	MAIN	225	
225		*12121K*A*H	MAIZ	226	
Ų.	1212	FURMAT(6X.3HRLZ.12.1H=.1PE20.12.5H*(T**(.1Pt14.6.2H))))	ZIV	727	
		V=D4H	Z Z Z W	000	
			* T &	2 3 =1	

S

FTN 4.8+498

230 231 232	233 234 235 236 236 237 238	239	2 4 4 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	250 251 252 253	255 256 257 258	260 261 262 263 263	265 266 267 268 269	271 272 273 274 275 275	277 279 279 280 281 282 283 284 285
N N N N N N N N N N N N N N N N N N N	M M M M M M M M M M M M M M M M M M M	E E E E E E E E E E E E E E E E E E E	ZZZZZZZ THUUUUU TAAAAAA TAAAAA	ZZZZZ HHTH HHTH ZZZZZ ZZZZZ	ZZZZZZ	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z
WRITE(3,1216)K,44,8 6 FURMAT(6X,3HDLZ,12,1H=,1PE20,12,6H*(T**(,1PEI4,6,2H)),3H*DT) A=ABD(K,K)*BBD(K,K) R=HHD(K,K),1,0		4 FORMAT(6X,2HVV,12,1H=,IPE20,12,6H*(1**(,IPE14,6,2H)) ) A=A*B WBB-I <sub>0</sub> WAITE(3,I228)K*A*B B FORMAT(6X,2HDVV,12,1H=,1PF20,12,6H*(1**(,IPF14,6EU),4DT)	*	DO I300 1=1•NM 1P=1•1 DO 1300 J=IP•NSPC A=1•0/ABD(1•J) B=+BBD(1•J)		LBLBL	*	* W *	## ITE (3.132) ((LBPL.LBC.K.LBU.K).k=1.NSPC) FOHMAI (6X.7HCM(IC) = .4 (AI.46.12.AI.1.) 4 4 (/5x.1H*.1X.4 (Ab.12.AI.1) ** 4 (/5x.1H*.1X.4 (Ab.12.AI.1) ** 4 (/5x.1H*.1X.4 (Ab.12.AI.1) ** ** ** ** ** ** ** ** ** ** ** ** **
1216	1220	1224	1232 1236 1236 1250		1258	1262 1268 1274	1278 1282 1300	2 C C C C C C C C C C C C C C C C C C C	132 C 114 C 144 C 84
230	235	540	245	250	255	260	592	270	280 245

ZZZZZZZZZ		ZZZZZZZ	: z z z z z z z z z :	zzzzzzzzz ============================	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	MAIN
MAIN FORMAT(IHC.2X.36HTHEKMAL CONDUCTIVITY OF THE MIXTURE.)  FURMAT(IHC.2X.35HTHEKMAL CONDUCTIVITY OF THE MIXTURE.)  WHITE(3.27.6)  WHITE(3.27.6)  WHITE(3.27.7)  WHITE(3.27.7)  WHITE(3.27.7)  WHITE(3.27.7)  WHITE(3.27.7)  WAIN  FORMAT(IHC.2X.69HNOTE IN THE FORMULA. LAMBDA MUST BE IN THE SAME U MAIN MAIN MAIN	S*R*VISC/(4*M), WHERE R=82.05 CM**3-ATM/M ) RT LAMBUA BACK TO CAL/CM-SEC-K, MULTIPLY )	MAINTE (6.123) ABST. BBS 1.111 MAIN MAIN MAINTE (3.2R2) BBST MAIN MAIN FORMAT (6x,1] HTASTLJ=T**(.]PE14.6.1H) ) MAIN MAIN FORMAT (6x,1] HTBSTLJ=T**(.]PE14.6.1H) ) MAIN BM=BAST-I.0 MAIN BM=BAST-I.0 MAIN MAINTE (3.13R2) BAST. BMST (5x,1) MAIN MAIN MAIN MAIN MAIN MAIN MAIN MAIN	) ESS)			£20.I2.IH~*IFE20.12*IH**/5X*IH**IX*
272 275 276 276	278 * 279 * 123	282	1382	O)	1234	286
590	295	305	315	320 325	330	

PROGRAM LOAUF

14.21.28

04/15/80

FTN 4.8+498

397

MAIN

FORMAT (6X+2HZ(+12+1H++12+2H)=+1++20+12+5H\*XXSV+12+1H-)

A=-16.0\*W(I)/(I5.0\*KGA)

RGA=82.05

WRITE (3,302) I . I . A . 1

302

MAIN

14.21.28	401 402 403 404	604 404 409 604 610	4 4 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	410 417 419 420	421 422 423 425	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	44444444444444444444444444444444444444	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4
04/15/80	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	M M M M M M M M M M M M M M M M M M M	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z		Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z			M M M M M M M M M M M M M M M M M M M
LOAUF 76/76 OPT=1 KOUNO=+-#/ 1HACE FTN 4.8+498	LBLP=1H(  IF (I.EO.I)WRITE (3,304)LBLP, ((LBHL,LBPL,LBT,K),K=2,NSPC),LBP  304 FORMAT (5X,1H*,IX,2AI,10 (2AI,12,AI),AI,/5X,IH*,IX,10 (2AI,12,AI))  IF (I.EO.NSPC)WRITE (3,304)LBLP, (LBBL,LBPL,LBT,K),K=1,NM),LBP  1F (1,FO.1,OR.1,FU.NSPC)GO TO 30,	1M=1-1 1P=1+1 WRITE (3,304)LBLP,((LHBL,LBPL,K),K=1,1M),((LBBL,LBPL,LBT,K), * K=IP,NSPC),LBP CONTINUE	WRITE (3,305)1,1,4,1 305 FORMAT (6X,2HDZ,12,1HS,12,1H=,1PE20,12,6H*UXXSV,12,1H- ) LBDT=2HDT 1F(1,E0,1)WRITE (3,306)LBLP,((LBBL,LBPL,LBDT,K),K=2,NSPC),LRP 306 FORMAT(5X,1H*,1X,2AI,10(AI,A2,12,AI),AI,/5X,IH*,1X,	* 10(A1.A2.12.A1 ) ) 1F(I.EQ.NSPC)WRITE(3.306)LBLP.((LBBL.LBPL.LBDT.K).K=1.NM).LBP 1F(I.EQ.NSPC)WRITE(3.306)LBLP.((LBBL.LBPL.LBDT.K).K=1.NM).LBP 1F(I.EQ.1.0R.I.EQ.NSPC)GO TO 309	#FITT (19306) LBLP ((LBBL.LBPL.LBPL,KD) *K=1.1M) .((LBBL.LBPL.LBDT.K) *  * K=1P.NSPC) .LBP  * CONTINUE  ** CO	WRITE (3,312)K*K 310 CONTINUE 312 FORMAT (6X,2HV(*12,3H)=X,12) NDIM=20 WRITE (3,428)NSPC*NOIM	WRITE (3,432) NSPC.NDIM LBX=IHX LBV=3H*V( C CONVERT RLM FROM CM**3-ATM/CM-SEC-K TO CAL/CM-SEC-K.  A=-4.0*RG/RGA WRITE (3,316) A ((LBBL.LBX*K.LBV*K.LBP)*K=I,NSPC)*LBP	316 F OKMAT (6X,44KRM=1PE14.0).2H*(14(3A1).12,43).12,41).72417.2 (7.57,11).7 (	320 CONTINUE 322 FORMAT(6X,3HDV(,12,4H)=0X,12,3(A1,A2,12,A1),12,A3,12,A1),A1, MA 4 S(/5X,1H+,1X,4(A2,12,A1,12,A3,12,2A1)) ) MA WRITE(3,546)NSPC,NUIM LBK=1H LBX=1HX LBUV=4H*DV( MA LBUV=4H*DV(	LRV=3H*V( %FITE(3+326)A+((L~BL+LHPL+LHX+K+LHDV+K+LHPL+LHPL+LHDX+K+LBV+K+LBP) * +K=1+NSPC)+LHP *26 FOFMAT(6X+SHDRLM=+1PE14+6+2H*(++A1+12+A4+1Z+2A1+A2+1Z+A3+1Z+A1+
PROGRAM LOAUF	.,				,					
,	004	405	410	415	450	425	430	044	445	455

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	U	* ZAI,10(/5x,1H*,ix,2(Al,12,A4,IZ,ZAI,A2,I2,A3,12,3AI)) ) THE ABOVE IS THE THERMAL CONDUCTIVITY FOR A MIXIURE OF MONATOMIC	MAIN	458 459	
	. J	COMPUTE THE CURRECTION FACTOR FOR POLYATOMIC GASES.	MAIN	460	
460			MAIN	194	
		IX	MAIN	295	
		3H*VD	MAIN	463	
			MAIN	404	
			MAIN	465	
465			MAIN	994	
			MAIN	467	
	702		MAIN	468	
			MAIN	695	
			MAIN	470	
027	706		MAIN	471	
	2		MAIN	472	
			Z	473	
	710		MAIN	474	
	•		MATA	475	
475	714		MAIN	476	
1	•		Z	477	
			MATA	47.9	
	718	FORMAT (6x-)1HPI M=RIM+(RI-)2-4H-RI 7-)2-3H)/B)	Z	614	
	•		MAIN	480	
083	722	FORMAT (6X.) 3HDRI M=DRLM+(DI + 12.4H-DLZ+12.5H) /B-(+2HRL+12.4H-RLZ+	MAIN	184	
	,		MAIN	482	
	725		MAIN	483	
	63.	714	N N	707	
		16 (-16 1-16 )	ZIV	מ מ	
900			77	707	
000				700	
	_		2742	000	
			2 3	000	
			2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	600	
			ZIV	064	
067		* ((LBPL,LBOX,J,LBVD,1,J,LBPL,LBX,J,LBUVD,1,J),J=1P,NSPC)	Z	164	
			ZIAN	765	
			ZIV	663	
			ZIV	767	
1			Z	495	
462	/30		MAIN	965	
			Z	165	
			ZIVE	800	
			ZIAM	7.7	
1			ZIV	200	
200			MAIN	501	
				205	
			2142	200	
			MAIN	504 101	
	735		Z	505	
505			2 2 2	506	
	25 /	T UTMAL (10.7) 10 TM	2142	200	
	27.3		214	000	
	* • U	- 10:-17:-00:-00:-00:-00:-00:-00:-00:-00:-00:-0	ZIV	510	
510	s C		MAIN	511	
	* 'U		MAIN	512	
			MAIN	513	
	4.00	X.I3HSULVE FOR UV.)	MAIN	514	
			1		

PAGF								
14.21.28	515 516 517 518 519 520	521 522 523 524 526 526 527	527 533 533 533 535 535	545 545 541 543 543	544 546 546 547 548	550 552 553 554 555 555 556	500 500 500 500 500 500 500 500 500 500	565 565 566 566 566 566 566 566 566 566
04/15/80	M M M M M M M M M M M M M M M M M M M	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z		Z Z	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	M M M M M M M M M M M M M M M M M M M	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z
FTN 4.8+498						.D.1.J.,J=IP.NSPC)		
0PT=1 ROUND=+-*/ THACE	WPITE(3,402)NSPC FURMAT(6X,2HV(,1Z,5H)=0.0) DU 405 K=I,NM WPITE(3,408)K,K,PHN CONTINUE FORMAT(6X,2HV(,1Z,4H)=DX,1Z,4H*kH/,1PEIZ,4)	K=I,NSPC 1,4I2) NSPC,K,K 1,4I4) NSPC,K,K E 6X,2HZ (,I2,IH,,I2,3H)=U,I2) I=I,NM J=IP,NSPC	WRITE (3.416)1.J.1.J. FORMAT (6X.2HZ (.) 12.1H 12.6H) = XXSU, 212) IF (J.NE.NSPC) WRITE (3.416) J.1.J. WRITE (3.41R) 1.J. FORMAT (6X.2HDZ.12.1HS.12.6H=DXXSU, 212) IF (J.NE.NSPC) WRITE (3.41R) J.1.J.	XXSD -22) I • I • ( (LBM•LBXXSD• I • J) • J=2•NSPC) -• 2HZ (• I2•IH•• I2•2H) = • 4 (AI•A4•2I2) • AI• -• IX•5 (A4•2I2•AI) ) ) SD 24) I • I • ( (LBM•LBD•I•J) • J=2•NSPC)	12.1HS.12.1H= 5(AS.212.A1)) .((Lbw.LbxxSD	XXSD*I*J)*J=IP*NSPC) 24)I*I*((LBM*LBD*J*I)*J=I*IM)*((LBM*LBD*I*J)*J=IP*NSPC) 28)NSPC*NDIM *9HCALL DEC(*IZ*IH**IZ*1IH*Z*IPS*IER) ) 32)NSPC*NDIM *9HCALL SOL(*IZ*IH**IZ*YH*Z*V*IPS) )	38)K.K.K .2HUV.12.2H=U.12.3H*V(.12.1H) ) I.NSPC 42)K.K .9HRHUV(1ST12.7H)=RH*UV.12)	******  ******  ******  HSP.CE DER OF UP-45IT
DF 76/76	WRITE (3,402)NSPC FORMAT (6x,2HV(,1Z,5 DO 405 K=1,NM WRITE (3,408)K,K,PHN CONTINUE	U0 410 K=1,NSPC WRITE (3,412) NSPC,K,K WRITE (3,412) NSPC,K,K CONTINUE FORMAT (6X,2HZ(,12,IH FORMAT (6X,2HDZ,12,IH OU 415 I=1,NM IP=1+1	WRITE (3.4 IG FORMATICALS IF (J. NE. NSP WRITE (3.4 IB FORMATICALS IF (J. NE. NSP	I=I LUXXSD=4HXX WRITE (3.422 FORMAT (6x.2 3.7/5x.1H*, LBD=5HDXXSD WRITE (3.424	FORMAT(6X,2 * 3(/5X,1H* U0 420 1=2, IM=I-1 IP=I+1 WRITE(3,422	* ((L8M*LBXXSD*) **RITE(3*424)1*) CONTINUE **RITE(3*428)NSP FORMAT(6X*9HCAL  **RITE(3*432)NSP FORMAT(6X*9HCAL  DO 435 K=1*NSPC	WRITE (3,438 CONTINUE FORMAT (6x,2) DO 440 K=1; WRITE (3,442) CONTINUE FORMAT (6x,9)	* W * NO - O
PROGRAM LOADF	405	410 412 414	416 418 415		422	420 428 432	435 438 440 442	225 108 0
	515	520 525	530	0 <b>7</b> 5	. 545	550 555	260	565

PROGRA	PROGRAM LOADF	76/76 OPT=I ROUND=++*/ THACE FIN 4.8+498	04/15/80	14.21.28	
			MAN	572	
	500	CONTINUE FORMATIEX.3HDDY.12.4H=DDU.12.1H/.F6.2)		573	
		HODY=3HODY	ZIV	574	
		WFITE (3.506) ((LBPL.LBDDY.K).K=I.NSPC)	Z :	2/5	
575	506	FURMAT(6X,5HDDYS=,8(A1,A3,I2),A1,2(/5X,1H*,1X,8(A3,I2,AI))))	2 2	575	
1		WRITE (3+510)	2 2 2	97.2	
	910	FURMAT(6X+IBHDYSYSG=(DYS/YS)**2)	2 2	570	
		00 515 K=I+NSPC	2 2	200	
		#RITE (3+518)K+K+K+K+K	ZIV	581	
580	SIS (	CONTINUE	MAIN	582	
		FOKMAT(6X*3HUUX*1Z*5H=1UUT*1Z*********************************	MAIN	583	
	•	1649A*()1515W*1*15*1EC-0515X*1EC-051		584	
		7.0HZ=7.0BT		585	
20	_	CH_07.		586	
200		SHI=dSHI		587	
	_	NN-1 =1 500 00 00 00 00 00 00 00 00 00 00 00 00	4 4	0000	
		WRITE(3,528)I.I.I.PHN, ((LBM.LBDZ.I.LBS.J.LBV.J.LBP).J=I.NSPC!		200	
	525	CONTINUE		165	
290	£O.	FORMAT (6X+3HOV (*1Z+VH)=(RH*UDO*1Z+TH*ORH=DA*1Z+Z+Z+Z+Z+Z+Z+Z+Z+Z+Z+Z+Z+Z+Z+Z+Z+Z+Z+		265	
	• 1	[PE]2.4.6].42.6[2.4].7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.	MAIN	593	
		4 (		294	
		LENSPEC TARGET OF THE BODY THE BODY THE BY T		595	
L	(	FXI [E (3.5327]; (1.564 LDDZ*1,1.53]; (3.545); (		296	
595	286	CARMATICAL   CAR		265	
		50/70/4174/4/7/5/4/7/5/4/7/5/4/7/5/4/7/5/5/5/5/5		298	
	546	FORMAT (6X,9HCALL SUL (. IZ, IH, . IZ, 10H, Z, DV, IPS)	ZIV	299	
	)	DO SEC KELL*NSPC		009	
009		WRITE (3.552) X * X * X * X * X	Z	601	
	0		2 2	200	
	555	FORMAT(6X,3HDUV,12,2H=U,12,4H*UV(,12,4H)+UU,12,3H*V(,12,1H))	Z 2	600	
		DO 8IO K=1,NSPC	2 2	600 605	
		*KITE (3*812)K*K*	NAM	606	
605	810	CONTINUE	Z	209	
	1	FORMAT(6X*10HDRHUV(1S1+*1Z*6H)=DRH*UV*1Z**********************************	MAIN	608	
			MAIN	609	
		1.00 - TE - 1.17 ULX * 1 - 1 - 1 () • 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	MAIN	610	
710		WRITE (3,612)	Z	611	
210	612	FURMAT (IHC. 2X, 26HFIND THE TIME LERIVATIVES.)	ZIV	612	
		WHITE (3.622)	2 2 4 4	613	
	622	FORMAT (6X+ ISHSP=ASF+BSF*I_ME)	MAIN	519	
§ .		TANDHUM ( PHN *PHN )	MAIN	919	
419		WRITE(3*020)	MAIN	617	
	920	FORME (1743)	MAIN	819	
	632	FORMAT (6X, 25HIF (KPUE, EQ. NPUE) 60 TO 150)	MAIN	619	
		WRITE (3.636) TMN	Z Z	079	
620	9£9	FURMAT(6X,3HRY=,1PE2U,10,8H*R(KHIE))	2 2	661	
		TMSPH=TMV/PHN	MAIN	623	
		*K  TK (3+638)  MSFE  	MAIN	624	
	038	EDITE CA. 640)	MAIN	625	
505	279	FORMAT (6X+23HFVAL=SP+UPH(KPDE)+DY+RY)	MAIN	626	
. 20	: }	WPITE (30646)	NAM	627	
	979	FURMAT (6X • 6HKETURM)	MAIN	274	

	PROGRAM LOADF	16/76	0PT=1	KOUNE	/#-+=0	OPT=I ROUND=+-*/ THACE	FIN	FTN 4.8+498	04,	04/15/80	14.21.28	ΡΑ(
		1077 67 44 44							_	MAIN	659	
	077	FOUNT IN THE STATE OF	31046) (17.2HTE0.2X.HHCONTINEE)	NOCHA	TIME				_	MAIN	630	
	8		TACHAS						_	MAIN	631	
630	677	FOUNT (6X 3H	3 4 2 5 7 1 H3 F 11 E 2 () - 1 () • 1 H*)	20.10	(*HI.				_	MAIN	632	
	200								_	MAIN	633	
	777		1 X • X I • 8	HOUN	CIL	*UPH(NPDE)	+RHLM (IC)	SYSSES TX ALTHORPH MCTC) *UPH(NPDE) +RHLM(TC) *UPH2(NPDE))	_	NIA	634	
	100									MAIN	635	
		LOCLEIN							-	MAIN	636	
0.50		LOCTOR I STATE OF THE POPULATION (TST	OHIN (10	_					_	MAIN	637	
		WOTTE (3.668)	THOUNT	C BB	. I RPI	LHC . K . L BR	1UV + LBPL +K			MAIN	638	
		# 1 DD								NIAM	639	
	679	_	TD==15	F 20.1(	0.12H*!	UPH (NPDE)	( + 2A I + A6 +	74x . 6HTD== . 1DF 20 - 10 - 12H*UPH (NPDE) * (+2AI+A6+I2+AI0+AI+IZ+3AI+		MAIN	940	
0.7	200		1 × 2 ( A K	12.4	TO.A.	X-14*-1X-2(A6-12-A10-A1-12-3A1))				MAIN	179	
0 40	06	NOTA WIT - OTONI							_	MIN	249	
		1 20-04 (	•						_	NIV	643	
		1 PH-0H) *H(1ST *	1						_	NIAP	944	
		WOTTE (3.672)	TMSTD.	BE	I BPI	Lak . K . LBH.	K+LBP) • K=	13.672) TMSTP. (() PRI .   BPI . LAH.K.LBH.K.LBP) . K=I.NSPC) . LBP	_	MAIN	645	
3//	673	COUNTIES AND CANANA	TOTAL	F 20 - 1	0.2H*	. 2 (2A I . A2	12.48.12.	A1) + 2A I +	_	ZIV	949	
040	910	TAHL VOLVE A	THE IX 2 (A2 12 AB 12 ABI)	12.4R	. 12 . 3 A	100			_	MIN	2 4 2	
		14" 111 AC / 17 T	J						_	MAIN	648	
	769	TALLE (31010)	HEVAL =	Hdilad:	(NPDF)	14 4. 35HFVA = SP*IPH (NPDF) + (TI +TR+TI) / CM (TC)	) / CM (1C)		_	MAIN	649	
	0/0	CIOD	1	:						NIA	650	
650		END							_	MAIN	651	
)												

241)

PROGRAM WILL BE ENTERED AT LOADF

	LCM LENGTH
4	L.C.M
2010110	
	20275
5	

		CNST H2 H2	VAR	2 2 2 2 2 2				•
		.79 280.00 .36945345E-14 58099162E-05	0.00 15.70	6522355E-14 .23240102E-05	VISCOSITY.	MAL CUNDUCTIVITY	v1SC0S11Y.	HERMAL CUNDUCTIVITY.
		00 -10 -02	00.0	-10	v I SC(	THERMAL	v 1 SC(	IMERI
FILE	25. + 10.13 26. + 10.13 27. + 10.13 28. +	m 1 1	97.50	.99807393E 12081500E .23580424E	1 H2	1 H2	I N2	1 N2
LENGTH	12777 144 144 144 100 100 110 110 110	2.92 10E-07 51E+01 74E+03	3.62	57235277E-06 .36748261E+01 10611588E+04	6.502900E-0	.3833004-0	6.613600£-0	7.999600101
	2	2	2.00	1.1		7	9-9 90-	
AUDRESS	110 13107 13110 13304 13310 13320 13361 13361 1362 14057 14057 14057 14057 15023 15073 15073 15073 15073 15073 15073 1701 17510 17701 17510 17701 17510 17701 17510 17701 17510 17701 17510 17701 17510 17701 17510 17701 1770	2.00 .51119464E-03 19629421E+01 18122739E-11	28.00	.15154866E-02 .61615148E+01 .22577253E-12	2.188700E-06	6.357900£-06	4.266700E-	6.40770UE-07
CK	LOADF /SIP.END/ /GB.IO./ /GB.IO./ /GB.IO./ /GB.IO./ /GB.IO./ /GET.IN= /FLT.IN= /FLT.IN= /FLT.IN= /FLT.IN= /FLT.IN= /FLT.IN= /FLT.IN= /FRYSYS= /FORSYS= /FORSYS= /FORSYS= /FORSYS= /FORSYS= /FRYSYS= /FORS			1				
вгоск	LOADE STATE CUMING FELTING FELTING FORSY FORSY FORSY FERCAPER ALOGEN ALOGEN ALOGEN STATE STATE STATE STATE ALOGEN ALO	1 HZ •31001901E+01 -•87738042E+03 •55210391E-08	N N	.28963194E+01 90586184E+03 63217559E-09	H	Н2	22	N2
	94	.3100 8773	~	.2896 9058 6321	-	-	~	~

			AL.	8* P. 1128, HIRSHFELDER, ET. AL.	В* Р. 1128, Н	1.129600E+00 -1.022500E-02	- 00E+009	1.129
			AL.	A* P. 1128, HIRSHFELDEM, ET. AL.	A* P. 1128, H	1.088500E+00 9.055700E-03	500E+00	1.088
			-03	TMN = 1.0000E-03	PHN = 5.0000E-05		RESS = 1.00 PN = 1.0000E+03	RESS PN =
BINARY UIFFUSION.	BINAR	N2	20	1.537400E-05 1.672900E+00	1.537400E-05	N2 N2	2	2
BINARY UIFFUSION.	BINAR	22	HZ	5.951700E-US 1.66380UE+00	5.951700E-05	H2 N2	2	-
BINARY DIFFUSION.	HINAR	Н2	HS	1.119300E-04 1.661400E+00	1.119300E-04	H2 H2	1	-

SUBROUTINE F(TIME,PH+U,UPH2,FVAL,NPDE,KPDE,IC,KSKT,KSKR) F UIMENSION Z(20,20),1PS(20)  UIMENSION Y(20),0V(20)  UIMENSION Y(20),0V(20)  UIMENSION Y(20),0V(20)	COMMON/TABAB/ASP. HSP. TPN. PHN. TMN. TMSPH. TMSPH. TMSTP. TPENT F COMMON/TABS/ASS. PSK. NPDEM COMMON/TABS/ASMALL COMMON/TABS/A	DIMENSION KICO)  DIMENSION C(1000) *H(1000) *RHLM(100) *ORHLM(100) *CM(100)  COMMON/TABCT/RL*CPMX*H0(20) *R2UM(20)  COMMON/TABME/RHUV(1000) *ORHUV(1000)	IN FVAL.	HZ ANO NZ. TRANSPORT WARNATZ PAR. F MASS FRACTIONS / MOLECULAR WEIGHTS. F F DE.IC.KSKR) F	IF (KSKT.6T.1)60 TO 100  IF (KSKR.6T.1)60 TO 125  C NTIS ENTHALPIES AND HEAT CAPACITIES.  IF (T.6T.1000.)60 TO 2000  C TIS.1000.)60 TO 2000  F 2.2  A 17 - 1000.04.04.104.104.104.104.104.104.104.1		+ 1* ( - 2.32401020E-004)* ( - 5.32173590E-10*)* ( - 2.25772530E-13))))	* * *	C 2=1.9872*( 2.89631940E+00+1*( 1.51548660E-03 * +T*( -5.72352770E-07+T*( 9.98073930E-11+T*( -6.52235550E-15)))) F H 2=1.9872*( -9.05861840E+02+1*( 2.89631940E+00 * +T*( 1.51548660E-03/2.0+T*( -5.72352770E-07/3.0 * +T*( 9.98073930E-11/4.0+T*( -6.52235550E-15/5.0))))	3000 CONTINUE  C SPECIFIC HEATS AND SPECIFIC ENTHALPIES.  C(1ST+ 1)=C 1/ 2.00  H(1ST+ 1)=H 1/ 2.00  C(1ST+ 2)=C 2/ 28.00	2)=H 2/ 24.00 JE FHOM WARNATZ ST PAR.
	rv.	0.1	51	20	52	30	35	0 4	<b>ئ</b>	50	55

116 117 118	120 121 122 123 124	125 126 127 128	129 131 132 133 134	135 136 137 138	140 141 143 144	145 146 147 149	150 151 152 153 154	155 156 157 158 159	160 161 163 164	165 166 167 168 169	170 171 172
L L L L	e ie ie ie ie i	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u>ie le le le le </u>	14 14 14 14 14 14	L L L L L	L L L L L	<u> </u>	لد ند ند
HIRSHFELDER METHOD FOR MDNATDMICS. P. 37A, TDULDUKIEN, LILEY, AND SAXENA. NOTE IN THE FDRMULA, LAMBDA MUST HE IN THE SAME UNITS AS D*P/T. LAMBDA=15*R*VISC/(4*M), WHERE R=22.05 CM**3-ATM/MDLE-K. TO CONVEDT I ANDRA DACK TO CALLOCKE	-03) -02) -02) 1*T**(	A	78E+00+ 1.970356 9818E-01*TASTLJ 38E+00*DTBST- 1.	C==AX SU	11E+00+ 9818E-01* 01E-02*DT	Z(2, 2) = -3.640056875889E-01*XSV 2- * (+T 1) DZ 2S 2= -3.640056875889E-01*DXXSV 2- * (+DT 1)	1ER)  S   +X  1*V( 1) +X 2*	DV( 1)=DX 1-DZ 1S 1*V( 1)-DZ 1S 2*V( 2) DV( 2)=DX 2-DZ 2S 1*V( 1)-DZ 2S.2*V( 2) CALL SDL( 2*20*Z*DV*1PS) DRLM= -9.687751E-U2*( *X 1*DV( 1)*DX 1*V( 1) *  * X 2*DV( 2)*DX 2*V( 2))	*DVD 1 Z 1*DSUM/ H	DRLM=DRLM+(DL 1-DLZ 1)/B-(RL 1-KLZ 1)*D3/(B*B) SUM=+X 1*V0 1 2+X 3*V0 2 3 DSUM=+DX 1*V0 1 2+X 1*DV0 1 2+DX 3*V0 2 3+X 3*DV0 2 3 B=1,0+0 2 2*SUM/X 2 DB=DU 2 2*SUM/X 2+DSUM/X 2+0 2 2*SUM*UX 2/(X 2*X 2)	FLM=FLM+1ML C-KLZ 2)/B UKLM=DRLM+(DL 2-DLZ 2)/B-(RL 2-KLZ 2)*DH/(B+B) SUM=+X 1*VD 1 2
50000											
115	120	125	130	135	140	145	150	155	160	165	170

14.21.44	173 174 175 175 176 177 179	1 1 9 8 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	186 187 189 190	191 192 193 194 195	196 197 198 200	201 202 203 204 205	206 207 209 210	2012 213 214 214 214	216 217 219 220	221 222 223 224 225	22 <b>7</b> 228 228
04/15/80	Le Le Le Le Le Le Le L	مامائد العاماد الد	. اساماد اماد اما	اعد اعد اعد اعد اعد	<b>LE LE LE LE</b>	L L L L L	ايد ايد ايد ايد ايد ا	. L. L. L. L.	لد اند اند اند اند	امد امد امد امد امد ا	e le le ce
IL F 76/76 OPT=1 ROUND=+-*/ THACE FTN 4.8+498	SU B=1 SRM SRL SRL SRL SRL	•	2	27 15 15 25 25 25 25 25 25 25 25 25 25 25 25 25	C SPACE DENSITY TIMES UV.	0 DY 1*DYS/YS+2.0*Y 1*DYSYSQ-Y 1 DY 2*DYS/YS+2.0*Y 2*DYSYSQ-Y 2	-05-0Z 1S 1	DUV 2=U 2*DV( 2) + DU 2*V( 2) DRHUV(IST* I) = DRH*UV 1 + RH*DUV 1 DRHUV(IST* 2) = DRH*UV 2 + RH*DUV 2 C FIND THE TIME DERIVATIVES. SP=ASP+BSP*TIME	100 CONTINUE 1F(KPDE.EG.NPDE)GO TO 150 1F(KPDE.EG.NPDE)GO TO 150 RY= 1.00000000000E-03*R(KPDE) DY=- 2.0000000000E+01*DRHUV(1ST*KPDE) FVAI = SP*HIPH(KPIF)+07*RY	RETURN 150 CONTINUE TL= 4.0000000000E+05* * (URHLM(IC)*UPH(NPUE)*UPH2(NPUE)) TI)=- 2.000000000E+01*UPH(NPUE)*(+C(151+ 1)*RHUV(151+ 1) +	* C(IST* 2)*RHUV(IST* 2))  TR=- 1.000000000006-06*( *P( 1)*H(IST* 1) *K( 2)*H(IST* 2))  FVAL=SP*UPH(NPDE)*(IL*TR*TD)/CM(IC)  RETURN
SUBROUTINE	175	180	185	190	195	200	205	210	215	220	225

04/15/80 14.21.44

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230

FIN 4.8+498

FIN

76/76 OPT=1 ROUND=+-#/ THACE

SUBROUTINE F

END

14.46.06	2	m ·	<b>4</b> (	Λ V	0 1	- a	0 0	10	: =	12	13	14	15	120	18	19	20	21	25	57		56	27	28	53	30	31	3.5	3 %	35	36	37	98	٠ د د د	7	25	43	77	2,	0 1	- d	0 0	20	51	52	53	4 r	<b>ئ</b> ر ر	57	a ac	i
04/15/80	MAIN	MAIN	ZIV	Z	2 7 4 5	2 4 4 2	ZZ	NIAM	Z W	T MA I	MAI	MAI	LEA MAIN	2 2 4 2	Z	MAIN	MAIN	MAIN	MAIN	ZZ	NIVE	ZIAM	MAIN	NIAM	MAIN	MAIN	Z	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	ZZ	MAIN	MAIN	MAIN	ZIV	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2 2 4 2	MATA	MAIN	NAIN	MAIN	ZZZ	Z	2 2 4 4	ZZ	MAIAM	MAIN	MAIN	-		7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	ZZZ	4
PROGRAM LOAUF 76/76 OPT=1 ROUND=+-*/ TRACE FIN 4.8+498	MANAGEMENT OANE (TAIDLIT - TAPES = INPUT , TAPE 6 = 00 TPUT ,					7,25),AL (7,25)	UIMENSION ALD(25), BLU(25), ABD(25,25), BBD(25,25)	01MENSION AV(25) + 64 (25)	DIMENSION LBPR(25)	WRITE (3.1000)	COMPLETE TRANSPORT CASES AL CO COL		IST DERIVATIVES TO BE ZERO. THIS CAN	*D TO DIVISION)	WRITE(3+1010)	1010 FORMAT(IMC.ZX.8HBY ZERO.)	WRITE (3+10+12)	1012 F OKMA 1000 B N-1414 DC: 1	10.14 FORMAT (0.4.32H1F (ABS (U(K)), LT.SMALL)U(K)=SMALL)	WHITE (3.1016)	1016 FORMAT(1X,1H5,4X,36H1F(ABS(UPH(K)).LT.SMALL)UPH(K)=SMALL)	READ (S+12) NLINE	12 FURMAT (1014)	2	UV C V N-11/NE DE AN (S. 22) 11	11(0,0)	20 CONTINUE	22 FORMAT (72A1)	24 FOHMAT(/1X•72A1/)	READ (5.12) NSPC	I-DASKIIEW		(HI=dX -		1020 FURMAT(6x,6HYN=1.0,8(A1,A2,I2,A1),A1,2(/5x,IH*,1X,	* 8(A2.12.A1.A1)) )	WITH (3+10.25)	1025 FORMALIONASUROPEL ALCONING CENTRAL CONTRAL CONTRACTOR CONTRAL CONTRAL CONTRAL CONTRAL CONTRACTOR CONTRAC	18 FORMAT (6X*4H) ST= [Z*7H*(IC-I)	00 30 K=1 NSPC	READ (5.32) LB(K) (K)	WRITE(6.34)K.LB(K).w(K)	READ(15,36) (AU(L,%), L=1,5), (II) (L) (L=1,5)	2.1 = 1.1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	PEAD (15.45) ( 11.1 ( 1.1 ) ( 1.1 ) ( 1.1 ) ( 1.1 ) ( 1.1 ) ( 1.1 ) ( 1.1 ) ( 1.1 ) ( 1.1 ) ( 1.1 ) ( 1.1 ) ( 1.1 )		MADITE (6.37) (AL (L.*K) - L=4.7) (II (L) - L=1.20)	BONIE CO	32 FUHMAT (A5.7F7.0)	34 FUWMAT (/2x.14.4x.a/>.4x.6/3.2/)	
	ı	<b>-</b>			ប	)				0 I				15	•			6	20				52				30	,				35				40				54	1				50				55		

	PROGRAM LOADF	76/76 OPT=I ROUND=+-*/ THACE FIN 4.8+498	04/12/80	14.46.0
	TANGOS 45	11800.0 30371	3	Ĺ
		AFIACAS ON THE LOCAL STATE OF THE STATE OF T	214	60
6.0	CACAMACA CEC	TODAY A LIBERT A CONTRACTOR AND A CONTRA		00
		11, 35,15,47	2 2	10
	27 FORMAT	(6x,22HIF(KSKT,GT,1)GO TO 100)		20
		200	NIV	9
	28 FORMAT	FORMAT (6X, 224 IF (KSKH, 6T, 1) GO TO 125 )	MATA	10 vc
65			AM	400
	N 07 00	DO 40 K=1+NLINE	MAIN	29
	READ (5,22) II	, 22) II	MAIN	68
		WRITE (3+22) II	MAIN	69
í		UE	MAIN	7.0
20			MAIN	7.1
		ENTHALPIES AND HEAT CAPACITIES.	MAIN	72
	*		MAIN	73
			MAIN	14
i	42 FORMAT	FORMAT(6X,24HIF(T.61.1000.)60 TO 2000)	MAIN	75
C	DO 50 K	K=I,NSPC	MAIN	16
	WRITE (3	WRITE (3.52) K+AL (1.K)+AL (2.K)	MAIN	77
	WKITE	3,54) (AL(L+K)+L=3,5)	MAIN	78
	WKITE (3	3.62)K.AL(6.K).AL(1.K)	MAIN	79
0		3.64) AL (2.K), AL (3.K)	MAIN	80
90		3+66) AL (4+K)+AL (5+K)	MAIN	81
	0 0		MAIN	82
	~ .	FORMAT (6Xe]HC+]Z+9H=1-9B7Z*(+]PE[6.8+4H+T*(+]PE[6.8)	MAIN	83
	<b>3</b>	(5X*1H**1X*3(4H*T*(*1PE16*8)*5H)))))	MAIN	98
N C		3,56)	MAIN	82
n 80	90	(6X+10HGU 10 3000)	MAIN	98
	SD FORMATC	FODMAT (HOOD) OX ONCONTINUE	ZIA	87
	9		2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	10 G
	ENTITIES AND THE PROPERTY OF T	3.527 K. 611() e.K) . 611(2.K)	STAF	500
06		3,514.) (ALL (1 eX ) =   H.3 e.).)	2141	2 6
	WRITE	3.62)K.AII(6.K).AII(1.K)	2 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	10
		WRITE (3.64) AU (2.K) + AU (3.K)	NIAM	60
	WRITE (3	3.66) AU (4.K) , AU (5.K)	MATA	0,0
		Æ	MATA	95
95	62 FORMAT (	16X.IHH.12.9H=1.9872*(.IPE16.8.4H+T*(.IPE16.8)	MAIN	96
		[5X+]H*+]X+4H+]*(+]PE]6.8+4H/2.0+4H+]*(+]PE]6.8+4H/3.0)	MAIN	16
		FORMAT (SX:1H*:IX:4H+I*(:1PEIG.8:4H/4.0:4H+I*(:1PEIG.8:	MAIN	98
	•	)•6H))))))	MAIN	66
100		FRITE(3)68)	MAIN	100
2	STAMAD T COMMAND	14H3UU+ZX+BHCONIINUE)	MAIN	101
	134	FORMATCHES 2 A SACHED FOLD HEATS AND SUFFIFIC ENTER DIES	Z	102
		S MIND SECTION	2 2	£01
	WRITE	() (() () () () () () () () () () () ()	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
105	WRITE (3)	- 144 ) X + X + X (X )	NIA	105
	0 4	CONTINUE	NAM	107
	142 FORMAT (6	FORMAT(6X,6HC(IST+,12,3H)=C,12,1H/,F6.2)	MAIN	108
	77	.6X+6HH([ST++12+3H)=H+[2+1H/+F6+2)	MAIN	601
	WRITE (3)	19146)	MAIN	110
017	140 FORMAI	* OKMAI(!X*JHIZD*ZX*BHCONIINUE)	MAIN	111
	THEDWAL	CATCHER OF THE CONTROL OF THE CONTROL OF THE PROPERTY OF THE CONTROL OF THE PROPERTY OF THE CONTROL OF THE CONT	Z I V	211
		CONDUCTIVITIES AND BINARY SIFFUSION CUEFFICIENTS. VISCOSITY. THE MAIL CONDUCTIVITY. AND HIS SOY OFFERED	7 2	113
	INDICIONAL DESCRIPTION OF THE PROPERTY OF THE		2	114
	C COULT ILIENI	IIS FROM A FILE CREATED BY VALUES. CY=6.	MAIZ	1.5

9																																									
14.46.0	116	118 119	120	122	123 124	125	127	128	130	131	132 133	134	136	137	138	139	141	142	143	145	146	147	0 4 1	150	151	152	154 154	155	156	. v.	159	160	161	163	10 t	166	167	168	170	171	2/1
04/15/80	MAIN	MAIN	MAIAM	ZZZ	MAIN	ZZZ	ZZI	MAIN	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	Z Z Z	Z I V X	MAIN	M M M	MAIN	MAIN	MAN	MAIN	ZIV	2 2 2 2 2 2	MAIN	MAIN	MAN N	N A N	MAIN	MAIN	NIAN	Z Z Z	MAIN	NA I	Z Z	MAIN	Z Z Z	X A X	MAIN	Z Z Z Z Z Z	MAIN	ZIV	NAM	MAIN	NAM	7
PROGRAM LOAUF 76/76 OPT=1 HOUND=+-*/ THACE FIN 4.8+498	C eeeeeeeeeeeeeeee	DO 72 K=1 • NLINE		/2 WRITE(3.22)11 79 FOHMAT(1HC,5X,1HV,12,1H=,1PE14.6,5H*(T**,1PE14.6,1H) )	READ(5.12)NLINE	READ (5,22)11	WRITE(3.22)II WRITE(6.22)II	70 CONTINUE	00 80 K=1.NSPC REAL(0.82) AV(K).11]	WRITE (6.84)K,LB(K).4V(K).8V(K).111	READ(9,82)ALD(K),8LD(K),1II  ***READ(9,82)ALD(K),1D(K)	CONT	82 FORMAT (IP2E 14.6+44A1)	DO 78 K=I+NSPC	Y	78 CONTINUE	UO 90 K = 1 + N > PC  WRITE (3, 40) K + 41 D (K) + 11 D (K)	INUE	92 FORMAI(6X,2HRL,12,1H=,1PEI4,6,5H*(T**,1PEI4,6,1H))	KEAU(5912)NLINE	READ (5,22) 11	WPITE (3.22) 11		LOCAL I NOE	00 110 1=1.NSPC		READ (9,82) ABD (1,43) *BBD (1,43) *III	CONTINUE	112 FORMAT (/2x,14,4x,14,4x,44,4x,44,1P2E14.6.44AI/)	PEAD (5.114) PRESS	**************************************	AT (	00 120 1#1*N™	00 120 J=1P•NSPC	ABD (1, J) = ABD (1, J) / PRESS	CON	122 F OPMAT (IHC.5X.IHU.212.1H=.IPE14.6.5H*(T**,IPE14.5.1H) )	****	*******************	Lepl	% F 1 TF (3•14F)
	115			120			125			130			(	32			14.0	t			I 45				150				155				160			165	•			170	

14.46.06	173	174	175	176	177	178	179	180	181	182	183	184	185	186	191	001	100	191	192	193	194	195	196	197	198	561	201	202	203	204	205	505	200	502	210	211	212	213	214	216	21.7	218	219	220	221	222	224	225	726	757	228	622
04/15/80	Z A	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	ZIV	NIAM	MAIN	MAIN	NAM	Z Z	2 7 4 8	2 7	NIAM	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	Z	ZZ	ZZZ	Z	2	MAIN	MAIN	MAIN	Z	ZIV	ZZZ	MAIN	MAIN	MAIN	Z	ZZZ	ZIV	MAIN	MAIN	MAIN	MAIN	ZIV	Z Z Z	ZZW	MAIN	MAIN	MAIN	MAIN	NIV
LOADF 76/76 OPT=1 ROUND=+-*/ THACE FTN 4.8+498	PODLATITUC OV THEODACE DEDIVAL) VEC		SN (071 %) 51 (03	14.0 FORMAT (6X.4HYS=Y-12)	DO 150 K=1+NSPC	SECTIF (9.) 10.) 5.X	CONTINUE	152 FORMAT(6X,1HX,12,2H=Y,1Z,3H/YS)	DO 160 K=1, NM	WRITE (3+162) K+K	#RITE (3,164) K*K	WRITE (3+166)K+K		62 FORMAT(6x,1HU,1Z,3H=U(,1Z,1H))	164 FORMAT(6X*2HDU,1Z*5H=UPH(,1Z*1H))		[BU=]HU	172 FODMATICK: HILL 12.4H=1.008(A)-4]-4]-12]-4]-12	* A(A) = [0.4] ) )	BDU=2HDU	WRITE (3+174) NSPC+ ((LBM+LBDU+K)+K=1+NM)	174 FORMAT (6x,2HDU,12,1H=,8(A1,A2,12),A1,2(/5X,1H*,1X,	*	LH00U=3H00U		176 FORMAT(6X,3HDDU,12,1H=,8(A1,A3,12),A1,2(/5X,1H*,1X,	* 8(A3,12,A1)))	TO THE COLLEGE TO THE		182 FORMAT (6X+2HDY+12+3H=DU+I2+1H/+F6+2)	F	WRITE(3,186)((LBPL,LBDY,K),K=1,NSPC)	186 FORMAT(6X,4HDYS=,8(AI,AZ,IZ),AI,2(/5X,1H*,1X,8(AZ,1Z,AI)) )	FOX=FXE 50/86.05	TEACH CANADA TANADA TAN	234 FORMAT (1HC,2X,5HTPN =,1PE12,4,6X,5HPHN =,1PE12,4,6X,	*		226 FORMAT(6X,13HDT=UPH(NPDE)*,1PE12.4)	WKITE(30Z4Z)FSK 3/3 FODWAT/KK,GHDBH=-1DF18,10,21H#(DT/T+DYC/YG)/(T#YG))	_	00 815 J=1.NSPC	IF (1,EQ, J) 60 TO 815	A=1.0/ABD(I.J)	R==8B0(I•J)	- `	813	DO 820 III) NAPE	00 820 J=1.NSPC		A=I.0/AHD(I.J)	H=−BHD(I・J)
PROGRAM LOADF	2	71		16	•		15	51					16	16	16	16		1.7	7			17				71			4	18		•	8			23			25	37.	J					2	0 3					
				175	-				180					185				000	06.7				195				6	200				202				210				310	612				220				225			

14.46.06	230	231	232	233	234	236	237	238	239	240	24 I	242	243	7.64	200	247	248	549	250	251	202	25%	255	256	257	258	526	260	261	262	264	265	566	267	268	569	175	272	273	274	275	276	277	279	280	Z8I	282	283	# U T	U	,
04/15/80	MAIN	MAIN	MAIN	MAIN	ZZZ	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	NAM	MAIN	MAIN	MAIN	MAIN	MAIN	ZIV	Z		ZZZ	MAIN	MAIN	MAIN	ZIV	2 2 4 2	Z	ZZZ			MAIN	MAIN		ZZ	2148		N N	MAIN	MAIN	MAIN	NAM	2 2 4 5	Z	ZIV	MAIZ	MAIN	ZIV	M N	2 2 4 5	Z	MAIN	MAIZ	NIV	Z Z Z	LUADS	
76/76 OPT=I ROUND=+-*/ THACE FIN 4.8+498		0.1-1-0	7 14	CONTINUE	822 FURMAT (6X, 3HOVD, 2I2, IH=, IPEI6.8,6H*(T**(,1PE I6.8,5H)) *DT)	****	SPECIFIC HEAT OF THE MIXIURE.		WALLE (3-12-4)  WALLE (3-12-4)  WALLE (3-12-4)	EC		32) ((LBPL,LUC,K	44 (6X, 7HCM (IC) = 14 (AI, 46, 12, A)	# 4 (/SX, IH*, IX, 4 (A6, 12, A3	*****************	THE KMAL CONDUCTIVITY OF THE MIXIONE.		#X1-[C)*()   #X1-[C)   #X1-[C)   #X1-[C)   #X1-[C)   #X1-[C)   #X1-[C)   #X1-[C)   #X1-[C]   #X1	72 FORMAT (1HC.2X, 36HTHERMAL CONDUCTIVITY OF THE MIXTURE.)	274 FORMAT (1HC, 2X, 24HMASON AND SAXENA METHOD. )	WRITE (3+252)	252 FORMAT(1HC,2X,55HLMIX=SUM(I)(L 1/(I,0+(SUM(J)P I J*X J)/X I))		WRITE (3,254)	S4 FORMAT (IMC, ZX, 69HP I J= (I, 005) 50, K = (0, 0 * (I, 00 * K)   1, K   1,	EDITE(3,200)	ິດ	WRITE (3,256)	256 FORMAT (1HC, 2X, 45HP 1 J IS A FUNCTION OF T AND CONSTANTS.	WRITE(3,258)	3 ()     -   -   -   -	00 275 1=1,0NSPC	16 (1. F.) J. 10 275	A=1.065/(2.0*50R1(2.0*(1.0***(1))))	B=SQR1(AV(1)/AV(U))*SQR1(SQR1(W(U)/W(I)))	C=(BV(I)-BV(J))/2.0	WRITE (3,271) B, C	MAI(6X+8HBIC=1+0++1FEZO+10#3H*!**(*1FEZO+10*1H) FF/3-276/1-1-A	711 10 10 10 10 10 10 10 10 10 10 10 10 1	)	• 😐	CONTINUE	X,1HP,12,1HS,12,1H=,1PE20,10,7H*BI	FURMAT (6X.2HUP	##1 ## ## ## ## ## ## ## ## ## ## ## ##	ンボフェンス・コークンドー	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	TE (3.282)K • ( (LBPL • LAPS • K • LBSP • J • LBX • J) • J=2	ZAZ FUMMAT(6X,44SUMP.12.1H=.5(ZAI.IC.AI.12.12).AI.	* 3(/5x•]H*•]X*5(A]•[/*A]•]2•AZ*!/•A]) )	IM.F.T.IOO
PROGRAM LOAUF				ac	30	O	0 (	ی	-	•			-		U	U (	ی		``	1 70		Ž.		(	Ñ		۸	•	Ñ		~						•	2				2	,v	2					~		
		000	630				235				24.0	1				542				250					255				260				245	707				270				275	I			000	ב ע			o c	785

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	PROGRAM LOAUF	)ADF 76/76 OPT=I HOUND=+-*/ THACE FIN 4.8+498	<b>m</b>	04/15/80	14.46.06	
		2). A1.9(/5x,1H*,1X,2(A2,12,A1,12,A2,12,2A1,12,A1,12	•A3•I2•AI))	MAIN	340	
7,5		50 765 XHI+NSFC		ZIAN	347	
0	765	100		MAIN	343	
	768	FURN	2H/X.12.	MAIN	344	
		₹		Z Z	345	
Ĺ		70 K=1.0SPC		Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	340	
350	047			ZZZ	348	
	772	FORMAT (6x+1HT+12+5H=(ORL+12+3H-RL+12+3H*0B+12+2H/B+12	,3H)/B.I2)	MAIN	349	
				MAN	350	
i (	ř		-	Z Z Z	351	
355	977	F UKMA [ (6X+5HUKLM=+1 V (ZA1+1Z/+A1+/5X+1H=+1A+1V (A1+1Z EDITE(3-774)	•	ZZ	353	
	778	FORK		MAIN	354	
		****		MAIN	355	
0 7 0	) ()	SOLVE FOR UV.		ZZZ	356	
200		*****		ZIV	358	
	)	WRITE (3,400)		MAIN	359	
	400			2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	360	
365				2 2 4 5	362	
200		XII.		MAIN	363	
		WRITE (3,402) K, ((LAPL, LBX, J, LBVD, K, J), J=2, NSPC)		MAIN	364	
	705		•	ZIV	365	
		* 5(AI+12+A3+212+AI)) )		MAIN NAC	366	
370		IF (NM.EG.) 60 TO 412		MAIN	247	
				ZIV	368	
		7 L + Y L +		MAIN	369	
		WRITE (3,402) K, ((LBPL,LBX,J,LBVD,J,K),J=I,KM), ((LBPL,LBX,J	, T • J • J	ZIVW	370	
375				ZIV	371	
	014			245	2,5	
	214	Z Z		MAIN	373	
		WHITE (3.402) K+ ((LBPL+LBX+J+LBVD+J+K)+J=1+NM)		MAIN	374	
380		00 415 K=I+NSPC		MAIN	375	
				Z Z	376	
	413	FORMATICK*ING*IO*ON=X*IO*AH*CUM*IO*IH**IO*4		ZZ	378	
	•	00 420 K=1+NSPC		MAIN	379	
385				MAIN	380	
	420	CONTINUE		ZIVE	381	
	224	FORM		ZZ	382	
		DO 4/70 FFI8/0/70 E 20 I I I I I I I I I I I I I I I I I I		ZZ	384	
340	425	CONT		MAIN	385	
	428	FOR		MAIN	386	
		00 465 K=1.0NSPC		Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	387	
	445	LNOU		2 Z	389	
395	468	FCHA		MAIN	390	
		00 470 K=I+NSPC		MAIN	391	
		FERIT		MAIN	392	
	470	CONTINUE FOUNTIAGE - 2011 - 12 - 21 - 21 - 12 - 21		ZIVE	305	
	21 2	E CHE		1	274	

	PROGRA	PROGRAM LOADF	76/76 OPT=1 KOUND=+-+/ THACE FIN 4.8+498	04/15/80	14.46.06	PAGE
400		. 476 F	LBUV=2HUV WKITE(3,476)((LBM,LBUV,K),K=1,NSPC) FORMAT(6x,3HDV=,8(A1,A2,12),A1,2(/5x,1H*,1X,8(A2,12,A1)))) DO 480 K=1,NSPC	M M M M M M M M M M M M M M M M M M M	395 396 397 398	
405		480 C	WRITE(3,482)K,K,K CONTINUE FORMAT(6X,2HUV,12,3H=UV,12,5H+UV*U,12) DO 485 K=1,NSPC	M M M M M M M M M M M M M M M M M M M	399 400 401 402	
410	25	485 488 684 5 7 884 7 844 8	WRITE(3,48A)K.K CONTINUE FORMAT(6X,9HRHUV(1ST+*12,7H)=RH*UV,12) ************************************	M M M M M M M M M M M M M M M M M M M	403 406 406 407	
415			2) •2X•30 •NSPC 2)K•K•	M M M M M M M M M M M M M M M M M M M	408 409 410 411	
024		508 508 508 1 ¥ L	CONTINUE COMMAT (6X,3HDDY,12,4H=DDU,12,1H/,F6.2) LBDDY=3HDDY WRITE (3,506) ((LBPL,LBDDY,K),K=1,NSPC) FORMAT (6X,5HDDYS=,8(A1,A3,12),A1,2(/5X,1H*,1X,8(A3,12,A1)))	ZZZZZZ ZZZZZZZ ZZZZZZ ZZZZZ	413 414 416 17	
425		510 F 00 D 515 C 518 F	WKITE(3+510) FORMAT(6X+18HDYSYSQ=(DYS/YS)+*2) DO 515 K=1,NSPC WRITE(3+518)K+K+K+K+K CONTINUE FORMAT(6X+3HDDX+12+5H=(DDY+12+7H-2.0+DY+12+13H+DYS/YS+2-0+Y+	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	6 1 1 8 6 7 1 1 8 6 7 1 1 9 6 7 1 9 6 7 1 9 7 1 9 7 1 9 7 1 9 7 1 9 7 1 9 7 1 9 1 9	
430			*9H*DYSYSQ-Y*12*12H*DDYS/YS}/YS } X=2HDX D=3H*VD =1HX VD=4H*DVD	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	4524 4524 4524 4524 453	
435		532 * E	K=1  WRITE(3,532)K,((LHPL,LBDX,J,LBVU,K,J,LBPL,LBX,J,LBDVD,K,J),  * J=2,NSPC)  * J=2,NSPC)  * FORMAT(6x,4HDSUM,12,1H=,2(A1,A2,12,A3,212,2A1,12,A4,212),A1,  * 9(/5x,1H*,1x,2(A2,12,A3,212,2A1,12,A4,212,A1))  If (NM,EQ,1)GO TO 541	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	429 431 432 433	
440		033 ¥ 0	DO 535 K=2,NM KM=K-I KP=K+1 WRITE(3,532)K,((LBPL,LBDX,J,LBVU,J,K,LBPL,LHX,J,LBDVD,J,K), * J=1,KM),((LBPL,LBDX,J,LBVD,K,J,LBPL,LHX,J,LBDVD,K,J),J=KP,NSPC) CONTINUE		4 4 3 3 4 4 4 3 3 4 4 4 3 3 4 4 5 3 4 6 5 3 4 5 6 5 6 5 6 5 6 5 6 5 6 6 6 6 6 6 6 6	
450		からなる 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	K=NSPC WRITE(3*532)K*((LBPL*LBDX*J*LBVD*J*K*LBPL*LBX*J*LBDVD*J*K)*J=1,NM) DO 540 K=I*NSPC WRITE(3.542)K*PHN*K*K*K*K CONTINUE CONTINUE FORMAT(6X*2H0B*12*1H=*1PE12*4*4H**(DX*12*4H**SUM*12*2H*X*12***)*******************************	M M M M M M M M M M M M M M M M M M M	44444 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	
455		54 <b>5</b> CC	00 545 K=1.NSPC WMITE(3,548) K*K*K CONTINUE	M M M M M M M M M M M M M M M M M M M	6 4 4 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	

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PRO	PRUGRAM LOADF	OF 76/76 OPT=I KOUND=+-*/ THACE FIN 4.8+498	04/15/80	14.46.06	
				ŗ	
	548	+B FOFMAT (6X*2HDT*12*12H=-ORH*(1.0-U*12*7H) *KH*DU*12)	Z	450	
		00 550 K=1,NSPC	Z	101	
		wrITE(3,552)(K.L=I./)		70,	
460	550	CONTINUE	2 1	45.5	
	255	FURMAT (6X,440FAC,12.1H=,24DT,12,24/8,12,24-1,12,3H*DB,12.	Z	424	
		* 3H/(8•I2•2H*8•12•1H) )	ZIVE	455	
		00 590 K=1. NSPC	ZIV	456	
		37.1FF(3.6.00/)	MAIA	457	
4.65	200	I I I I I I I I I I I I I I I I I I I	MAIN	458	
	2007	FOUND 1 CAR SOUND 12 SHIPF AC 12 SHEDRAL 10 SHOP AC 12 SHOWN 1 CAR SOUND 1 CAR	MAIN	459	
	246	SO THE RESIDENCE OF THE PROPERTY OF THE PROPER	MATA	46.0	
			MAIN	194	
		TYPE CONTRACTOR CONTRA		101	
	265	CONTINUE	2 :	204	
0.45	ഗ	FURMAT(6X,3HDUV,12,3H=DU,12,2H*V,12,2H+U,12,3H*UV,12)	2	463	
		LBUUV=3HDUV	Z	494	
		WRITE(3,802)((LHM*LHDDUV•K)•K=1•NSPC)	MAIN	465	
	802	FURMAT (6x,4HDDV=+8(A1,43+I2)+A1,2(/5x+IH*+IX+8(A3,I2+AI))))	MAIN	466	
	•		MAIN	467	
7.75		70 10 10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	MATA	468	
0.			MATA	469	
	808	CONTINUE TO AND THE AND	NIVE	670	
	0	FORMAT (BX+3HDV+1Z+4H=DUV+1Z+5H+DV+DU+1Z+5H+DV*U+1Z)	2 2 2	7.4	
		DO 8I0 K=1.NSPC	2145	1 .	
		▶ XITE (3*812) X • X • X	2 <b>V</b>	2/5	
480	810	CONTINUE	MAIA	473	
	812	FORMAT (6X.10HDRHUV (1ST+.12.8H) = URH*UV.12.7H+RH*DUV.12)	MAIN	7/7	
	÷	***	MAIN	475	
	یا د	FIND THE TIME DESIVATIVES.	MAIN	476	
			MATA	477	
				478	
483	- (	WALLE (3+012)	2747	70	
	210	FORMAL (INC. CA COMPTIND THE TIME DENIALISE)	2142		
		*XI   E (3+02C)	2 4 7	107	
	622	FORMAT(6x*ISHSP=ASP*BSP*TIME)	7	184	
		TMSPT2=TM2/(PTN*PTN)	2	\ \tau_1	
064		WRITE (3+628)	ZIV	483	
	628	FORMAT(1x+3H100+2x+6HCONTINUE)	ZIVW	484	
		WR1TE (3+632)	MAIN	485	
	632	FORMAT (6x,25H)F(KPDF,FQ,NPDF)60 TO 150)	MAIN	486	
	1	WOTTE (3.6.5.4) TMN	MAIN	487	
40.7	454	FORMATION OF THE PRINCIPLE OF THE PRINCI	MAIN	488	
1	2	TOTAL	MAT	644	
		WO TITE (20.7 TM COM	MAM	007	
	6.30	FINAL TAXABLE TOF A DEVICE TO TAXABLE TO TAX	Z	167	
	5	E T T T T T T T T T T T T T T T T T T T	MATA	665	
	64.3	FACE TO A PARTY OF THE CAPACITY OF THE CAPACIT	N	604	
200	Ų	10.10 TO 10.	MATA	707	
		TACH TACAN T	MAN	404	
	0	TOWNS TO THE TOWNS	Z	404	
	074	TALIFOLDATOLOXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	Z	167	
3	С	DO GENERAL LENGTH OF THE CONTRACT OF THE CONTR	Z	804	
cnc		1	NIV	004	
	4	7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 -	MATA	200	
	000	CONTINCE FORMATINE	Z	100	
	750			100	
		)\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		502	
016		LANDERDOUGH TO THE	2 2	מ מ	
		WELLE (JOSEPH AND TOTAL	7 2	100	
	950		7	000	
		#RITE (3•662) IMSPH?	MAIN	905	

	PROGRAM LOADF	F 76/76	0PT=1	ROUND=+-#/ THACE	141 /s	ıce	FTN 4	FTN 4.8+498	04/15/80	04/15/80 14.46.06	9	PAGE
15	299	FORMAT (6X,3HTL=,1PE2U,10,1H*) WRITE (3,664)	IL=+ 1PE	20.10.1H*					Z Z	507		
	799	FORMAT (5X,114,1X,41H(DRHLM(IC)*UPH(NPDE)+KHLM(IC)*UPH2(NPDE)) LBBL=1H	x.41	H (DRHLM (1)	10. (C	(NPDE) +RHLM	(JC) *U	1PH2 (NPDE)))	Z Z Z	509 509 510		
20		L8C=6HC(1ST+ L8RHUV=10H)*RHUV(1ST WRITE(3*668)TMSPH*((L8H)*!HP)* HC*K* HRHUV* HP)*K=1*	HUV (IS	I BRI • I RPI	T	X-I HRHUV-I H	<u>.</u>	0 0 1 1	ZZZZ	511		
	999	* NSPC) .LBP FORMAT (6X,4HTD=-,1PE20,10,12H*UPH(NPDE) * (*2A1,46,12,410,41,12,	.0=-•1PE	20.10.12	*UPH(	NPDE) * (+2A]	46,12	.A10.A1.12.	MAPIN	514 515		
25		* 3A1,10(/5x,1H*,1X,2(A6,12,A10,A1,12,3A1)) ) TMSTP=TMN/TPN LBR=ZHR(	H* 1 X 1	:(A6•12•A]	0.41.	12•341)) )			M M M M M M M M M M M M M M M M M M M	516 517 518		
	672	LBH=BH)*H(1ST+ WR1TE(3*672)TMSTP*((LBBL*LBPL*LHM*K*LBH*K*LBP)*K=1*NSPC)*LBP FORMAT(6X*4HTR=-*1PE20*10*2H*(*2(2A1*A2*12*AB*12*A1)*2A1* * 9(xx*1H**1x*2(A2*12*A4*12*A4)*)	.+ MSTP ( ( R=-, 1PE	LBBL . LBPL 20.10,2H*	1 LHK.	K, LBH, K, LBP	.K=1,	NSPC) .LBP	A A A A A A A A A A A A A A A A A A A	519 520 521		
30	919	WRITE (3.676) FORMAT (6X,35HFVAL=SP*UPH(NPDE)+(TL+TR+TD)/CM(1C) STOP END	FVAL=SP	*UPH (NPDE	) + (TL	, +TR+TD)/CM()	(0)		M M M M M M M M M M M M M M M M M M M	523 524 525 526		

	SCOP	E 2 L 0	A U M A P			LOADER VERSION	ON 1.0	04/15/80	14.46.14.
OGRAM	₩1LL RE	ENTERED AT	LOADF (	241)		SCM LENGTH	16152	LCM	M LENGTH
	BLOCK	ADDRESS	LENGTH	FILE					
	LOADF	110	11104	L60					
	/FCL.C./		30	SL-F TNL 1B					
	/08.10	`.	144	SL-FTNL 18					
	COM10=		10	SL-F INLIB					
	FECMSK=		41	SL-F TNL 18					
	FEIFST=		3	SL-F TNL 18					
	FL 1021=		156	SI -FINITE					
	FMTAP=		377	SL-F TNL 18					
	FORSYS=		300	SL-F TNL IB					
	FORUTL=		ֆ դ Ն 4	SL-FINLIB					
•	INCOM		144	SL-FINLIB					
	INPC=	13350	173	SL-F INL 18					
	11 /		476	SL-F TNL IB					
	KKAKEKU	,	4 ህ ተ ር ቤ	SL-FINLIB					
	OUTCOME		204	SI -FINITB					
	ERRCAP		317	SL-FINLIB					
	FERCAP=		171	SL-F INLIB					
	EXP.MSG		16	SL-F TNL IB					
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310019 877380	31001901E+01 87738042E+03 -	.51119464E-03	.52644210E-07 .30574451E+01	-0734909973E-10 +01 .26765200E-02	3E-10 ,36945345E- 0E-u2 -,58099162E-	45E-14 H2 62E-05 H2			
201700	20 - N								
u	J								
289631 905861 532175 V1SCOS VEAST THERMAL	94E+01 84E+03 59E-09 - 1TY FROM SQUARES - CONDUC	28963194E+01 .1515486E-0257 90586184E+03 .61615148E+01 .36 53217559E-0922577253E-1210 VISCOSITY FROM WARNATZ ST PAR. LEAST SQUARES F11, T=300,2000. THEFMAL CONDUCTIVITIES FROM WARN LEAST SQUARES F11, T=300,2000.	748261 748261 611588 IATZ ST	E-06 .99807393E-10 E+0112081500E-02 E+04 .23580424E+01 PAR.	3E-1065223555E- 0E-02 .23240102E- 4E+01	02E-05 02E-05 02E-05			
-	42	2.188700t-06	36 6.502900£-01	E-01 H2	v1SC0S1TY.				
-	Н2	6.357900E-06	06 7.383300E-U	E-01 H2	IMERMAL CONDU	CONDUCTIVITY.			
~	N N	4.2667UUE-06	06 6.613600E-0	E-01 142	v15C0S11Y.				
~	22	6.407700E-07	07 7.999600E-01	c01	1. ERMAL CONDUCTIVITY	JCTIVITY.			

BINARY DIFFUSION COEFFICIENTS FROM WARNATZ ST PAR. LEAST SQUARES FIT. T=300.2000.

* * * * * * * * * * * * * * * * * * *	BINARY DIFFUSION.	BINARY	Z Z	N2 N2	1.537400E-05 1.672900E+00 N2	N2 1.537400E-05 PHN = 5.0000E-05	N A A	N2 0E+03	2 2 NZ TPN = 1.0000E+03	~ Z
ž	UIFFUSIO	BINARY	22	N	1.672900£+00	1.537400E-05	N2	2	2	
•	BINARY UIFFUSION.	BINARY	N N	HZ	5.951700E-05 1.663800E+00 H2	5.951700E-05	NS	H2	2	
·	BINARY DIFFUSION.	BINARY	HZ	HS	1.119300E-U4 1.661400E+00	1.119300E-U4	H2	H2	-	

OPT=1 HOUND=+-\*/ THACE

SUBROUTINE F

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5 6 6 6 8 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8	65 66 68 68 69	7 7 7 7 7 7 7 7 7	75 76 78 78 80	9 8 8 8 1 1 2 5 5 4 1	88 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	940 944 944 955	98 99 99 100 102 103	105 106 109 111 111 115 115 115
		. L. L. L. L. L		<u> </u>				
C LEAST SOUARES FII. T=300,2000. C THERMAL CONDUCTIVITIES FROM WARNATZ ST PAR. C LEAST SOUARES FII. T=300,2000. C V l= 2.188700E-06*(1** 6.502900E-01) C V Z= 4.266700E-06*(T** 6.613600E-01) RL l= 6.357900E-06*(T** 7.383300E-01)	RL Z= 6.407700E-07*(T** 7.999600E-01) C BINARY DIFFUSION CUEFFICIENTS FRUM WARNATZ ST PAR. C LEAST SQUARES FIT, T=300.2000. C PRESS = 1.00 C PRESS = 5.951700E-05*(T** 1.663800E+00)	X 1=Y 1/YS X 2=Y 3 X 1=Y 1/YS X 2=Y 2/YS U 1=U(1)	0.0 1=0PH( 1) 0.0 1=0PH2( 1) 0.2 2=-00 1 0.0 2=-00 1 0.1 1=00 1/ 2.00	DY 2=DU 2/ 28.00 DYS=+DY 1+DY 2 C TPN = 1,0000E+03 PHN = 5,0000E-05 TMN = 1,0000E-03 DT=UPH(NPDE)* 1,0000E+03		C MASON AND SAXENA METHOD. C LMIX=SUM(1) (L 1/(1.0+(SUM(J)P 1 J*X J)/X 1))		# 1=1.0+5UMP 1/X 1 # 2=1.0+5UMP 1/X 1 # 2=1.0+5UMP 1/X 2 RLM=+RL 1/B 1+RL 2/B 2 RHM(IC)=RH*RLM C SPACE DE OF DENSITY TIMES THERMAL LOND.  URL 1= 4.694228E-06*(T**( -2.616700E-01))*UT UYSY=DYS/(YS*YS) UX 1=DY 1/YS-Y 1*UYS-Y USUMP 1=FDY 1/YS-Y 2*UYSY USUMP 1=+DP 1S 2*X 2+P 1S 2*UX
09	59	0.4	75	08	85	06	100	105

14.10.20	2	m	4	r.	•	_	oc (	<b>5</b> `	0 .	Ξ:	21	7.	<u>+</u> u	9	17	18	61	20	21	22	24	7,	<b>5</b> 6	27	28	59	30	31	35	ي د د د	, T	3,5	37	38	36	0 7	T 7	7 6 7	7 4	45	46	47	87	4 r 0, c	ט ני	י ני	53	5,6	55	56	57	æ. æ
04/15/80	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	Z V	MAI	MAI	2 4 4 4	NI VI VI VI	τ		MAIN	MAIN	MAIN	ZIV		2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	MAN	MAN	MAIN	MAIN	MAIN	NAM	Z Z	ZIVE	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	ZZZ	NAM	MAM	MAIN	MAIN	MAIN	NIAN	Z Z Z	ZZ	MAIN	MAIN	MAIN	Z Z	Z Z	2 2 4 5	Z	M	MAIN	MAIN	NAN	<b></b>	MAIN
FIN 4.8+498	7E6=00TPUT.						25+25)				CASE - WE DO NOT WAN		Z							1ALL)	( ) ( ) HGH ( X ) = CM01 ( )			AU AND PRINTED.												(•IH*•1X•		33							1 (1 ) -1 -1 -	1 (1) 1 = 1	1-146-1					
OPT=1 HOUND=+-*/ THACE	PROGRAM LOADF (19PUT+OUTPUT+TAPES=INPUT+TAPE6=OUTPUT	APE15)	SUBMOUTINE F IN FLSC.	2)	(44)	5) • W (25) • AU (7•25) • aL (7•25)	25) + HLU (25) + ABD (25 • 25) • 5HU (2	5) • 84 (25)	(25)		SAHFOR THE COMPLETE TRANSPOR		TOTAL TO CIBET OF BINATIVES	Schincia Inst Derivatives		3HBY 2ERO.)		3 S K=I+NPDEM)	WRITE (3+1014)	. (ABS (U(K)) • LI • SMKLL) U(K) = SM	IAMP TILL ( X) HOLL SHALL HAS X	** A COLLET L'ADOLOGICA COLLEGICA CO		ER OF COMMENT LINES TO BE RE						2					(LHM.LEU.K.LBP).K=I.NM)	=1.0.8(A1.A2.12.AI),AI,2(/5X	( (1	A STATE OF	ALL RIVORINGRANDEANNORALCAN	T=+12+7H*(IC-1) )		·*(K)	3 (X) • ¥ (X)	READ(15-36)(AU(L·K)·L=1·5)·(111(L)·L=1·5)	(L •K) •L=1•5} • (111(L) •L=1•5} (1 •K) •l =6•7) • (A  (1 •K) •l =1•3}	(L • K) • ( T • C) • ( A • ( T • K) • ( T • F) • ( T • K) • ( T •	(L•K)•L=4•7)•(111(L)•L=1•20)	(L+K)+L=4+7)+(III(L)+L=I+20)		[[	*X * AS * 4X * F B * //)	541)
76/76	PROGRAM LOADF	* TAPE 3. TAPE 9.T.	LUAUF CREATES THE	UIMENSION 11 (7)	DIMENSION 111 (	DIMENSION LB (2)	DIMENSION ALD (	DIMENSION AV (2)	DIMENSION LBPR	WHITE (3, 1000)	FORMAT (IHC+2X+	THE U VALUES OR	FOUNT 1410057	*D TO DIVISION	WRITE (3.1010)	F ORMAT ( IHC , 2X ,	WRITE (3.1012)	FORMAT (6X . 14HD)	WRITE (3,1014)	PURMAI (6X, 3ZHI)	FOUNAT(1X-1HE-	DEAD (S. 12) NI JNI	FORMAT (1014)	INE IS THE NUMBE	DO 20 K=1+NL1NE	READ (5,22) 11	WRITE (3,22)11	CONTINUE	FURMAT (72A1)	FURMAT (/IX+72A)	MEAD (5+12) NSPC			LBP=IH)	WRITE (3,1020) (	FURMAT (6X+6HYN:	* 8(A2.12,A1.A	WRITE (3,1025)	WELLE (2. 18) NSP	FURMAT (6X,4HIS	UU 30 K=1.NSPC	READ (5.32) LB (K)	WR1TE (6.34)K1LF	READ(15.36) (AU	WKI IE (6+36) (AU	WD1TE (6.34) (All	WEAD (15.37) (A)	WR1TE (6.37) (AL	CONTINUE	FURMAT (A5.7F7.	F OHMA T (/2x . 14 . 4	FORMAT (SEIS.8.5
PROGRAM LOADE			0 T O								1000		400	6001		1010		1012	•	1014	7101	0101	2	יי טיי				50	25	54						1020			6201	18	1								30	ŽĘ	34	36
	_	,			2					2				5					0				7.					30					D.				0 +				45				9	>				5		

	PPUGRAM LOAUF 76/76 OPI=1 ROUND=+-*/ I~ACE FIN 4.8+49	98 04/15/80	14.10.20
	37 FORMAT (4F15.8.20A1)	MAIN	92
	NWI "NMAL (CEC "S) OV JA	MATA	60
4.0	000	7	2,4
00	202	7101	10
	OF ENDMATTER SOUTH OF THEM TO I	2 4 3	43
	EDITE (3.36)	2 2 2	600
	TOTAL ST. CO. T. T. C.		† L
Ļ	V	2 1 2 2	S .
69		MAIN	99
	00 40 K≈I•NLINE	Z	19
	KEAD(5,22)11	MAIN	68
	WRITE (3,22)11	MAIN	69
	40 CONTINUE	MAIN	10
10	S	MAIN	11
	J	MAIN	7.2
	**	MAIN	73
		NAM	74
	42 FUNAT (5x, 24H) F (1, 61, 1000, 160 TO 2000)	MAM	75
7.2	i	MAN	1.6
1		2 4	7.
	コフューロックリー・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・	7 7 7	4
		7141	0 6
			. 0
0		2 2	0 6
2	Ĺ	2	10
	CONTINUE	Z	82
	52 FUKMAT(6X.1HC.12.9H=1.9872*(.1PE16.8,4H+T*(.1PE16.8)	MAIN	83
	_	MAIN	98
		NIAM	85
85	26	MAIN	98
		MAIN	87
	58 FORMAT (4H2000,2X+8HCUNTINUE)		88
	00 60 K=1.NSPC		89
			06
06			91
	WK1TE(3,62)K+AU(6,K)+AU(1,K)		95
	WK1TE(3.64)AU(2.K).AU(3.K)		93
	WK1TE(3.66) AU(4.K).AU(5.K)		76
	09		95
95	29		96
	64 FORMAT(5X*]H**1X*4H*T*(*1PE16*8*4H/2*0*4H*T*(*1PE16*		16
	66 FURMAT (5X,1H*,1X,4H+1*(,1PE16.8,4H/4.0,4H+1*(,1PE16.		98
	* 4H/5.0.6H))))))		66
			100
100	68		101
	WRITE(3+134)		102
	134 FURMAT(1HC,2X,39HSPECIFIC HEATS AND SPECIFIC ENIMALPIES.	^	103
	00 140 K=1•NSPC	MAIN	104
	¥K1TE (3∗142)K∗K+¥(K)	MAIN	105
105		NIAM	106
		NAM	107
	142 F OKMAT (6X-6HC (15T++) IC+ 1C+ 1C+ 1C+ 1C+ C+ C	ZIV	108
	_	7	601
		Z	011
011	145	ZIVE	
	THE CONTRACT OF THE CONTRACT O		211
			511
	C READ IN VISCOSITY, HERMAL CONJUCTIVITY, AND BINARY OFFI	W.	114
		MAIN	115

	PRUGRAM LOADE	Ψ.	ADF 76/76		0PT=I	ROUN	ROUND=+-*/	1 HACE	FIN		4.H+49B	04/15/80	14.10.20	50	<u>a</u>
		3													
115		S	****	*****	*****	* *						MAIN	9 I I		
			READ (5.12) NLINE	ONLIN	LLI							ZIV	117		
			00 72 K=I	Z	u.							2 2 2 2 2	2 1		
			MEAD (50CC	111				KEAU (5022) 11				2 2 4	120		
120		72	WK11F (3.2	1112								MAIN	121		
		20	FORMAT (1H	C .5X	I HV • 1	=HI+	• I PE 1 4	6.5H*(T**,1)	PE14.6	• IH)	_	MAIN	122		
			READ (5.12	NIN	لعا							MAIN	123		
			DO 70 K=1.NLINE	.NLIN	ليا							MAIN	124		
			RE AD (5,22) 11	111								MAIN	125		
I 25			WR11E (3.2	2) 11								MAIN	126		
			WR11E (5+2	2) II								Z	127		
		7.0	CONTINUE									ZIV	128		
			U0 80 K=1.NSPC	•NSPC								Z	129		
			KEAD (9,82) AV (K),68V (K),111	) A C K	1000	11.6	1	111				2 2	131		
1 30			# 4 1 1 2 1 0 3 0 4 7 4 1 1 0 (K) 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1010	I He CX	X X	11	1111				Z	132		
			WRITE (6,84) K, LB (K), ALD (K), BLD (K), 1	4) K.	8 (X)	LDCK	BLD (	K) • 11 I				MAIN	133		
		80	CONTINUE									MAIN	134		
		80	FURMAT (1P2E14.6.44A1)	2E14.	6 • 4 4 A ]	_						MAIN	135		
135		84	FURMAT (/2	X . 14 .	4X + A4	4X+11	2E14.	6.44A1/)				NAIN	136		
			00 78 K=1	*NSPC								MAIN	137		
			WRITE (3+79) K+AV(K)+BV(K)	9) K + A	V(K).	3 v (K)						Z	138		
		18	CONTINUE									Z	139		
			DO 90 K=1	•NSPC								MAIN	140		
140		1		. (3,92) K, ALD (K) , BLD (K)	LD(K)	BLD (	C					Z	141		
		06	CONTINUE	į					,			Z Z	142		
		95	FORMAT (6X	. SHRL	12,14	1= • 1P	14.6.	FORMAT(6X,2HRL,12,1H=,1PE14,6,5H*(T**,1PE14,6,1H)	4.6.1H	<u> </u>		Z	E 4 1		
			READ (5,12									Z	u t		
L			00 I 00 K=	O K=1 NLINE	LI Z							2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	145		
145			KEAD (5,22) II									2 2	140		
			WALLE (SOC	11/2								2 7 7 7	149		
		100	CONTINE	11/2								Z	140		
			NM=NSPC-1									MAIN	150		
150			DO 110 1=	0 1=1.NSPC	c							MAIN	151		
			DO 110 J=	J=I •NSPC	· c							MAIN	152		
			READ (9,82	) ABD (	1.1).	10 Q86	11.00					MAIN	153		
				12) I •	J.LB()	1) • 6	(J) • AB	WRITE(6+112)1+J+LB(1)+LB(J)+ABD(I+J)+BBD(1+J)+111	11.((	1		MAIN	154		
l		110					;			;		ZZZ	155		
155		112		X + L 4 +	47.14	4 X 9 A	4 • 4 • •	F UKMA  (/ZX+14+4X+14+4X+44+4X+4++4X+1FZE14+0+44A / DEAD/E-11/1DDFCC	. T W # # # 0			ZZ	150		
		7 1	FORMATIFE	10.0	n							MAN	158		
		† .	WRITE (3.1	(3.116) PRESS	55							MAIN	159		
		116	FURMAT (1H	T (1HC, 2X, 7HPRESS	7HPRES	30 = S	(2.9)					MAIN	160		
160			00 120 1=	0 1=1 .NM								MAIN	161		
												MAIN	162		
				J=IP NSPC	ည							ZIV	163		
			AHD (I • J) =	• J) = ABD (1 • J) /PKESS	4d/()•	tess.		:				ZZ	164		
			* X X I	62010	O-ARD	10.1	(3+122)1+3+AFD(1+3)+BBD(1+3)	•				2 2 2	165		
165		122		, L	[C.0]H	100	1.101.	A. S. S. HOP (100)	10114.	1111	-	ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	167		
		770	* *	****	*****	4 4 4			2			MAIN	168		
		ں ،	SPACE DERIVATIVE	TIVES								MAIN	69 I		
			****	****	* * * * * * *	* * *						MAIN	170		
0 L I			LBPL=1H+									ZIV	171		
			WHITE (3.14R)	4H)								ZIAM	21 I		

14.10.20	230 231 232	233 235 236 237	238 239 240 241	244 244 244 244 244 244 344 344 344	251 252 253 253	255 256 257 258 259 260	261 262 263 264 265 265	268 269 270 272 273	275 277 278 279 280	281 282 283 284 285 285
04/15/80	M M M M M M M M M M M M M M M M M M M	2	N N N N N N N N N N N N N N N N N N N	N N N N N N N N N N N N N N N N N N N	M M M M M M M M M M M M M M M M M M M	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	N N N N N N N N N N N N N N N N N N N	X X X X X X X X X X X X X X X X X X X	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z
PROGRAM LOADF 75/76 OPT=1 ROUND=+-#/ 1HACE FIN 4.8+498	A=1.0/ALD(K) H=-BLD(K) A=A+Θ	H=B-1.0 WRITE(3.813)K.A.8 809 CONTINUE 813 FORMAT(6X,340VL,12,1H=,1PE16.8,6H*(T**(,1PE16.8,5H))*UT)	00 815 1=1.NSPC 00 815 J=1.NSPC IF (1.EQ.J)60 TO 815 A=1.0/ABD(1.J) B=-BRD(1.J) BD11F(3.A19)1.1.0.A.B	#15 CONTINUE #18 FORMAT(6X,2HVD,2I2.1H=.1PE16.8+6H*(T**(.1PE16.8-2H)) ) #18 FORMAT(6X,2HVD,2I2.1H=.1PE16.8+6H*(T**(.1PE16.8-2H)) ) #10 #20 I=1.NSPC #16 (I=EQ,J) GO TO #20 #1-BRD(I.J) #1-BRD(I.J)	A=A*B B=B*1.0 WRITE(3.822)1,J.A.B 820 CONTINUE 820 CONTINUE 820 FORMAT(6x.34DVD.212.1H=.1PE16.8,6H*(T**(.1PE16.8.5H))*DT)	C SPECIFIC HEAT OF THE MIXTURE. C ************************************	LBU=3H)*U WRITE(3*132)((LBPL*LBC*K*LBU*K)*K=1*NSPC) WRITE(3*132)((LBPL*LBC*K*LBU*K)*K=1*NSPC)  * 4(/5x*1H**1X*4(A6*12*A3*12)*A1*  C **********************************	77 40 77 8 € F	LBMIX=5HRLSUM WRITE (3.260)LBMIX.((LHPL.LBX.K.LHRL.K).K=1.NSPC) Z60 FURMAT (6X.A5.1H=.6(ZAI.12.43.12).AI.2(/5X.1H*.1X. + 8(AI.12.43.12.41)) ) LHSRL=3H*U.L	WRITE (3.260) LHMIX. ((LBPL.LBX.K.LSRL.K).k=1.NSPC) WRITE (3.265) WRITE (3.265) Z65 FOMMAT (6x.15HRLS1V=1.0/RLS1V) WPITE (3.270) WRITE (3.306)
	230	235	240	545	250	255	992	270	275	286

S

	PROGRAM LOADF	F 76/76	0PT=1 ROUND=+-*/	*/ IMACE	FTN 4.8+498	04/15/80	14.10.20	
	90	FURMAT (6X . I SHRHLM (IC) =RH*RLM)	RHLM (IC) =RH*RL	(M)		NIAM	287	
	COP			COMBINITION OF THE M	L 21 L 2	7 ; 4 ;	288	
				1	MINIORE.	2 2 4 4 2	200	
290		WHITE (3,312)				Z	291	
	312	FORMAT (1HC+2X+40HSPACE	40HSPACE DER	DENSITY TIMES	THERMAL COND.)	MAIN	292	
	,	WRITE (3,745)					293	
	145	FORMAT (6X, 16HE	)YSY=DYS/(YS*Y	(S)			567	
Ċ		DO 750 K=I NSPC	ပ္			MAIN	295	
662		ONTINE (3.752) K.K.K	ו×				962	
	750	CONTINUE FORMATIEN	201116			ZIV	297	
		HODE	121212H-0111Z+	13H-U111212H/12-111212H*U1S1	-		298	
		I HDX=2HDX				2 2 4 2	662	
300		LBM1X=SHOLSUM				Z Z	300	
		WRITE (3.760) LB	MIX. ((LBPL.LB	WRITE (3,760) LBMIX, ((LBPL,LBX,K,LHDRL,K,LBPL,LBDX,K,LBBI,K)	LBDX (K + LBB1 + K) .	Z Z	301 204	
		* K=1,NSPC)				MAN	303	
	760	FORMAT (6X, A5, 1	H= , 2 ( 2A I , 12 , A	FORMAT (6X, A5, 1H=, 2 (2A1, 12, A4, 12, A1, A2, 12, A3, 12), A1	IZ) . AI.	MAIN	304	
0	~	* 6(/5X,IH*,1X,	3(A1.12.A4.12	** AI * A Z * 1 Z * A 3 * I Z * A	1)))	MAIN	305	
505		LBMAK=IH)				ZIV	306	
		LEDVI =4H*DVI				2 2	307	
		WRITE (3+765) LB	MIX+ ( (LBPL+LB)	DX * K . LBSRL • K . LBPL	·LBX·K·LBDVL·K) ·	ZZ	300	
		* K=1 .NSPC)				N N	310	
310	165	FORMAT (6X, A5.1	H=+2(A1+A2+12	. A3. I2. 2A1. 12. A4.	12) • A1 •	MAIN	311	
	4	6 (/5X. IH*, IX.	3 (A2, 12, A3, 12.	* 6(/5X*1H*,1X*3(A2*12*A3*12*2AI*12*A4*12*A1)) )	• • •	MAIN	312	
		WRITE (3,770)				MAIN	313	
	0//	FURMAT (6X+24HDLS1V==RLS1V*RLS1V*ULS1V WD1TE (2-27E)	LSIV=-KLSIV*R	LSIV*ULSIV )		MAIN	314	
315	775	FALLE (34175) FORMAT (4x-22MPD) M-0 SA(D) CHM-H) CHM	112 107 82 0-M 10			MAIN	315	
1		WRITE (3.778)	ALM-0-5- 10LSU	M*ULSIV) /		N A N	316	
	778	FORMAT (6X - 25HD)	RHI M (TC) =DRH*E	W + M + M + M   M		7 7 7	317	
	*	-	****			Z Z Z	310	
	SOL	VE FOR UV.				MAIN	320	
320		HIRSHFELDER AND CO	CURTISS APPROXI	APPROXIMATION.		MAIN	321	
	C THE	THE VELOCITY OF THE LAST	HE LAST SPECIE	TERMINED	ONLY BY THE RELATION	MAIN	322	
		YI*VI = 0.0	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			MAIN	323	
		WRITE (3.400)	****			ZIAM	324	
325	004	FORMAT (IHC, 2X, 13HSOLVE	FOR	١٨٠)		2 2 4 8	365	
		LBX=1HX				Z	327	
		LHVD=3H*VD				MAIN	328	
		N=1 WUTTE (3.4.02) K	1 1 - X 0 1 - 100 17 7	ממוע כ-ז ען אַ־עומנו		MAIN	329	
330	604	FURMAT (6X . 3HSUN	\\C\C\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	FORMAT (6x • 3HSUM • 12 • 1H= • 5(2A) • 12 • 42 = 2 • NSPC)		Z Z	330	
		3 (/5x, IH*, 1X,	5 (A1 . 12 . A3 . 212	2.A1)))		ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	1331	
		1F (NM.EQ.1) GO	10 412			LOADEXA	336	
		DO 410 K=2.NM				MAIN	333	
225		XZIIXI I				MAIN	334	
550	_	WPITE (3.4.02)K.	1 1 20 1 10 10 11 11 11 11 11 11 11 11 11 11	ONE CONTRACTOR		MAIN	335	
	*	* LHVD•K•J)•J=KF	P+NSPC)	C. (3)		ZIAN	336	
	017	CONTINUE				Z Z Z	338	
34.0		CONTINUE				LOADF X3	2	
2 + 0		UO 4 LU KHI • NA BX 1 TF (4•4 10) X • X • X • D : S	J. C. A.			ZIVW	339	
	415	CONTINUE				7 7 4 4 5	340	
						> 1 x E	7 + 5	

• 20																																																					
14.10	345	343	344	342	346	34.	X (	349	350	351	352	353	354	355	356	357	200	260	36.0	362	363	364	365	366	367	368	369	370	371	316	276	375	376	377	378	379	380	381	285	707	385	386	387	388	389	390	168	7	306		395	396	397
04/15/80	MAIN	MAIN	MAIN	ZIW	ZIV	MAIN	MAIN	Z	N N	MAIN	NAN	ZIV	ZIV	ZIV	Z	Z	2 2 2	2 2 2	ZZ	Z	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	ZIV	MAIN	Z Z	2 4 8	ZZ	MAIN	MAIN	MAIN	MAIN	MAIN	Z Z	ZZZ	2 2	MATA	MAIN	MAIN	MAIN	MAIN	MAIN	NAM	Z Z Z	Z W	LOADEX3	MAIN	MAIN	MAIN
PROGRAM LOADF 76/76 OPT=1 KDUND=+**/ IHACE FTN 4.8+496	418 FORMAT (6X, IHB, 12, 2H=X, 12, 4H*SUM, 12, 1H*, 1PE12, 4)	U0 420 K=1.NM	≥ 5.1 T F ( 3.0 4.0.2 ) ★ 5.		422 FUHMAT(6x.1HT.12.11H=-RH*(1.0-U.12.1H) )	7 00		CONT I NUE	Σ	00	EXITE (3.468) K. K. K			DO 470 K=1,0M		470 CONTINUE		L HUV = ZHUV	CONTRACTOR	474 FORMATICAL - 1HE - 10 (4 1 - 4 1 - 4 1 - 4 1 0 (4 2 - 1 2 - 4 1 )	CONTRACTOR AND CONTRA	10 10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		489 FURMAT (6X-94RHUV (1ST+-12-7H)=RH+UV-12)	*****************	C SOLVE FOR THE SPACE DEMINATIVE OF UV.	******************	WRITE (3+522)	522 FORMAT(1HC.2X.30HSPACE DER OF DEWSITY TIMES UV.)	00 500 K=1 NSPC		500 CONTINUE 2000 10-4H=DD1-12-14/6F6.2)	N.	MRDJ - JUNDI - MPL - LHDDY-K) - K=1+ENPC)	506 FORMAT (6x,5HDDYS=+8(AI+A3+I2)+AI+2(/5x+IH++IX+8(A3+I2+AI)) )	WHITE (3+510)	510 FORMAT(6X.18HDYSYSU=(DYS/YS)**2)	00 515 K=1.NSPC		7.7			L8VD=3H*VD	LBUVD=4H*UVD	LBx=1Hx		WRITE(3,532)K,((L9PL,LBDX,J,LBVU,K,J,LHPL,LHX,J,LBDVD,K,J),J=2,	* NSPC)		TF(NM,FG,1) GO TO 33.7		( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )	7 T II + + + + + + + + + + + + + + + + +
PROGH			345					350					355					360				345	0.50				370				1	3/5				380				L	CH5				390				Joc	345			

## DYS/YS+2.0*Y.  ## IN HAIN			ZTAN	345
WHITE (3-422)K+K  WANTAINE (3-422)K+K  WANTAINE (3-424)K+K+K  WANTAINE (3-424)K+K+K  WANTAINE (3-424)K+K+K  WANTAINE (3-424)K+K+K  CONTINUE  CONTI		(64*  H13*  Z*:ZH=X*  Z*4H*>OM*  Z*  H**  PE  Z*4   0 K=  *NM	MAIN	343
CONTINUE		(3+422)K•K	MAIN	344
DO 425 K=1,NM   WHITE (13-42R)K+K-K   WHATA (145.11H=20H)(15-2H/8-12)   DO 425 K=1,NM   WHITE (13-42R)K+K-K   CONTINUE		NUE	MAIN	345
DO 455 K=1.NH WHITE (13.4-28).NH WHITE (13.4-28).NH WHITE (13.4-28).NH ND 456 K=1.NH WHITE (13.4-28).NH ND 456 K=1.NH ND 456 N=1.NH ND 456 N=1		î	MAIN	346
## ## ## ## ## ## ## ## ## ## ## ## ##		5 X=1,00	MAIN	347
FORMATI (6x, 3)# FAC.12.4 H=T.12.2 H/U.12)		(3.42K) N. 6K. 6K	Z M	34R
## 100 456 K = 1.00 0.0 465 K = 1.00 0.0 400 0.0 400 K = 1.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.		100 CT - 100 CT - 100 CT - 200	Z Z	545
## ## ## ## ## ## ## ## ## ## ## ## ##		F K=1.NM	2 3	950
CONTINUE FORMATIGE, 1HV-12+4H=FAC-12+3H*UA+12) HAIN UD 470 K=1,4M UD 470 K=1,4M UD 470 K=1,4M UD 470 K=1,4M CONTINUE FORMATIGE, 42+21K K*K* FORMATIGE, 42+21K F*I H= 10 LA1-A2+121-A11-SX+1H*, IX+10 (A2-12+A1)) HAIN FORMATIGE, 42+31K F*I H= 10 LA1-A2+121-A11-SX+1H*, IX+10 (A2-12+A1)) HAIN FORMATIGE, 42+31K F*I H= 10 LA1-A2+121-A11-SX+1H*, IX+10 (A2-12+A1)) HAIN FORMATIGE, 43+61K F*I H= 10 LA1-A2+121-A11-A11-A11-A11-A11-A11-A11-A11-A11-		7.5.4.6.8.5.8.6.8.6.8.6.8.6.8.6.8.6.8.6.8.6.8	2 2	155
FORMATION-12-4H=FAC-12-3H*UA-12    U0 4-0 K=1,MH   WITE(13-472)K**K*   WITE(13-472)K**K*   FORMATION-12-2H-U-12-2H*V-12    FORMATION-12-2H-U-12-2H*V-12    FORMATION-12-2H-U-12-2H*V-12    FORMATION-12-2H-U-12-2H*V-12    FORMATION-12-2H-U-12-2H*V-12    FORMATION-12-2H-U-12-2H*V-12    FORMATION-12-2H-U-12-2H-U-12-2H*V-12    FORMATION-12-2H-U-12-2H-U-12-2H-U-12-2H-U-12    WITE(13-486)K*K*   CONTINUE   CONTINUE   CONTINUE   CONTINUE   CONTINUE   FORMATION-12-2H-U-12-2H-U-12    WITE(13-52)   FORMATION-12-2H-U-12-2H-U-12-2H-U-12    WITE(13-52)   FORMATION-12-2H-U-1			MATA	353
## WITE (3.472) K, K, K  CONTINUE  FORMATICAS, 2HUV: 12. 2H=U.12. 2H=V.12)  FORMATICAS, 2HUV: 12. 2H=U.12. 2H=V.12)  FORMATICAS, 2HUV: 12. 2H=U.12. 2H=U.12. 2H=V.12)  FORMATICAS, 2HUV: 12. 1H=: 10 (A1.A2:12).A1./5X·1H** 1X·10 (A2:12.A1))  ## A1N		I (6X, 1HV, 12, 4H=F AC, 12, 3H*Ux, 12)	MAIN	35.4
WITTE (3.4.72) K.K.K CONTINUE FORMAT (6X.2HUV.12.2H=U.12.2H=U.12.2H=V.12) WATTE (3.4.72) K.K.K WATTE (3.4.72) K.K.K WATTE (3.4.72) K.K.K WATTE (3.4.72) K.K.K WATTE (3.4.72) WATTE (3.4.72) WATTE (3.4.72) WATTE (3.4.72) WATTE (3.4.72) WATTE (3.7.72) WATTE (3.7.74) WATTE (3.7.74			MAIN	37.7
CONTINUE LBUY=2HU MAIN MAIN FORMAT(6X,9HUV,12: JH=,10(A1;AZ*12)*A1;/5X*1H*,1X*10(A2*12*A1)) MAIN FORMAT(6X,9HCHUV(1ST*,12*7H)=HH*UV,12) MAIN FORMAT(6X,9HCHUV(1ST*,12*7H)=HH*UV,12) MAIN FORMAT(6X,9HCHUV(1ST*,12*7H)=HH*UV,12) MAIN MAIN FORMAT(1HG,2X,30HSPACE DER OF UENSITY TIMES UV,) MAIN FORMAT(1HG,2X,30HSPACE DER OF UENSITY TIMES UV,) MAIN MAINE(3,5G2) MAIN FORMAT(1GX,3HODY,12*H+DDU,12*H/,FG,2) MAIN FORMAT(6X,3HODY,12*H+DDU,12*H/,FG,2) MAIN MAIN FORMAT(6X,3HODY,12*H+DDU,12*H,FG,2) MAIN MAIN MAIN MAIN MAIN MAIN MAIN MAIN	WRITE	(3°472)X°X°X	Z	456
FORMAT(6x, 2HUV=12, 2H=U+12, 2H=V+12)		VUE	Z	357
LENUY=2HUV  LHH=1H=1H  WRITE (3.476)NSPC.((LUH.LBUV.K).K=1.NH)  NAINE  FORMATIC (3.468)K.K.  CONTINUE  FORMATIC (3.468)K.K.  CONTINUE  FORMATIC (3.522)K.K.W.K)  WRITE (3.522)K.K.W.K)  CONTINUE  FORMATIC (3.480)K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.		T(6X, 2HUV, I 2, 2H=U, I 2, 2H*V, I 2)	MAIN	35.8
HAIN WRITE (3.476) NSPC.((LUM+LBUV,K) +K=I+NH) FURHAT (6X.2HUV+I2-1H=+10(AI+AZ+12)+AI+/5X+1H*+IX+10(AZ+12-AI)) HAIN U 465 K=1.485C WRAIN CONTINUE FURHAT (6X.2HUV+IZ-1H=+10(AI+AZ+1Z)+AI+/5X+1H*+IX+10(AZ+1Z+AI)) HAIN FURHAT (6X.3HUV+IZ-1H=+10(AI+AZ+1Z)+AI+/5X+1H*+IX+10(AZ+1Z+AI)) HAIN FURHAT (6X.3HUPKE) FURHAT (6X.3HUPKE) FURHAT (6X.3HUPKE) FURHAT (6X.3HUPKE) HAIN WRITE (3.522) FURHAT (6X.3HUPKE) HAIN FURHAT (6X.3HUPKE) HAIN CONTINUE		VUH2	MAIN	359
WAITE (3.4.46 N. NSPC. ((LHW.LBUV.K) K= 1.4M)  U 485 K=1.WDV  U 486 K=1.WDV  U 50 FOR THE SPACE DELYVIIVE OF UV.  WAINTE (3.5.2D)  HAIN  HAIN  HAIN  HAIN  HAIN  HAIN  HAIN  U 50 FOR THE SPACE DER OF UE.NSITY TIMES UV.)  HAIN  HAIN  HAIN  HAIN  U 50 FOR THE SPACE  U 50 FO	LBM=1	-	MAIN	360
FORMAT (GA, 2 HUV, 12, 1H=, 10 (A1, A2, 12), A1, 5 x, 1H*, 1 x, 10 (A2, 12, A1))		(3,476) NSPC. ((LBM.LBUV.K).k=I.NM)	MAIN	361
DO 465 K=18 NSPC WHITE (3.468) K*N CONTINUE CONTINUE CONTINUE FORMAT (21.468) K*N FORMAT (21.4688) K*N FORMAT (21.4688) K*N FORMAT (21.4688) K*N FORMAT (21.4688) K*N		[(6X,2HUV,12,IH=,10(A1,A2,12),A1,/5X,IH*,1X,10(A2,12,A1))	MAIN	362
WAITE (3.46B) K.K  CONTINUE FORMATIC (5.49BRHUV (1ST*12.7H) = HH*UV*12) ***********************************	87 00	5 K=I,NSPC	MAIN	363
CONTINUE FOR THE SACE DEMINATIVE OF UV. ************************************		(3•48B)K•K	MAIN	364
FORMATIONS PRINCE STATE SPACE DERIVATIVE OF UV.  ***********************************		4DE	MAIN	365
SOLVE FOR THE SPACE DERIVATIVE OF UV. ************************************		[(6X,9HRHUV(IST+,12,7H)=RH*UV,12)	MAIN	366
## ## ## ## ### ### ##################	0		ZIVE	367
## ## ## ## ## ## ## ## ## ## ## ## ##	S s	THE SPACE DEMINATIVE OF UV.	MAIN	368
##IN FORMAT(INC.22,304SPACE DER OF DENSITY TIMES UV.) ##IN FORMAT(INC.22) K.K.* (K)  DO 500 K=1,NSPC  WRITE(3.502) K.K.* (K)  CONTINUE FURMAT(6K,3HDDY.12.4H=DDU.12.1H/.F6.2)  HOND FURMAT(6K,3HDDY.12.4H=DDU.12.1H/.F6.2)  HOND FURMAT(6K,3HDDY.12.4H=DDU.12.1H/.F6.2)  HOND HOND HOND HOND HOND HOND HOND HON			ZIV	369
DO 500 K=1,NSPC WRITE(3,502)K,K,W(K) WRITE(3,502)K,K,W(K) CONTINUE FURMAT(6X,3HDDY,12,4H=DDU,12,1H/,F6.2) FURMAT(6X,3HDDY,3D,4H=DDU,12,1H/,F6.2) FURMAT(6X,3HDDY,3D,4H=DDU,12,1H/,F6.2) FURMAT(6X,3HDDY,3D,4H=DDY,12,4H=DDU,12,1H*,1X,8(A3,12,A1))) MAIN FURMAT(6X,3HDDY,3D,4H=DDY,4K,K,K,K,K,K,K,K,K,K,K,K,K,K,K,K,K,K,K	·		Z	370
## ## ## ## ## ## ## ## ## ## ## ## ##	AEMU 720	ICINCACAGONSPACE DER OF DENSITY LIMES UV.)	Z	371
CONTINUE FURMAT(6X,3HODY.12,4H=DDU,12,1H/.F6.2) FURMAT(6X,3HODY.12,4H=DDU,12,1H/.F6.2) MAIN WRITE(3.506)((LBPL.LEDDY.K).K=1.NSPC) FORMAT(6X,5HODYS=*8(AI.A3.12).AI.2(/5X,1H*.IX,8(A3.12.AI))) MAIN WRITE(3.516) FORMAT(6X,5HODYS=*8(AI.A3.12).AI.2(/5X,1H*.IX,8(A3.12.AI))) MAIN FORMAT(6X,5HODYS=*8(AI.A3.12).AI.2(/5X,1H*.IX,8(A3.12.AI))) MAIN WRITE(3.516) WRITE(3.518)K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.	TI CM	13 14 14 15 15 15 15 15 15 15 15 15 15 15 15 15	2 2	3/2
FURMATICX, 3HDDY, 12, 4H=DDU, 12, 1H/, F6,2)  LEDDY=3HDDY  WRITE (3,506) ((LBPL-LEDDY, K) + K=1, WSPC)  FORMAT (6X,5HDDYS=*8 (AI, A3,12) + AI, 2 (/5X,1H*, IX,8 (A3,12,AI)))  FORMAT (6X,5HDDYS=*8 (AI, A3,12) + AI, 2 (/5X,1H*, IX,8 (A3,12,AI)))  MAIN  WRITE (3,510)  FORMAT (6X,3HDDYSYSU= (DYS/YS)**Z))  WRITE (3,518) K, K, K, K, K, K  CONTINUE  FORMAT (6X,3HDDX, 12,5H=(DDY, 12,7H-2,0*UY, 12,13H*UYS/YS+2,0*Y)  MAIN  FORMAT (6X,3HDDX, 12,5H=(DDY, 12,7H-2,0*UY, 12,13H*UYS/YS+2,0*Y)  MAIN  WRITE (3,518) K, K (LHPL, LHDX, J, LHPL, LHX, J, LHPL, LHX, J, LHY  WRITE (3,532) K, ((LHPL, LHDX, J, LHYU, K, J, LHPL, LHX, J, LHX)  WRITE (3,532) K, ((LHPL, LHDX, J, LHYU, K, J, LHPL, LHX, J, LHX, LHX)  WRITE (3,532) K, ((LHPL, LHDX, J, LHYU, K, J, LHPL, LHX, J, LHX, LHX, LHX)  WRITE (3,532) K, ((LHPL, LHDX, J, LHYU, K, J, LHPL, LHX, J, LHX, LHX, LHX, LHX, LHX, LHX, LHX, LHX	500 CONTIN	10.000 New Year Co.	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	3/3
LBDDY=3HDDY WRITE(3+506)((LBPL+LEDDY+K)+K=1+WSPC) FORMAT(6X+5HDDYS=+8(A1+A3+12)+A1+2(/5X+1H*+1X+8(A3+12+A1))) WRITE(3+510) FORMAT(6X+18HDYSY5U=(DY5/YS)+*2) WRITE(3+510) FORMAT(6X+3HDDYSY5U=(DY5/YS)+*2) WRITE(3+518)K+K+K+K+K+K CONTINUE FORMAT(6X+3HDDX-12+5H=(DDY+12+7H-2+0*UY+12+13H*UYS/YS+2+0*Y+) MAIN WRITE(3+518)K+K+K+K+K+K CONTINUE FORMAT(6X+3HDDX-12+5H=(DDY+12+7H-2+0*UY+12+13H*UYS/YS+2+0*Y+) MAIN LBDX=2HDX LBDX=2HDX LBUD=3H*VD LBX=2HDX LBVD=3H*VD LBX=2HDX LBVD=3H*VD LBX=1HX WRITE(3+532)K+((LBPL+LBDX+J+LBVU+K+J+LBDVD+K+J)+J=2+MAIN WRITE(3+532)K+((LBPL+LBDX+J+LBVU+K+J+LBX+J+LBDVD+K+J)+J=2+MAIN WRITE(3+532)K+((LBPL+LBDX+J+LBVU+K+J+LBX+J+LBU+LBX+J+	502 FURMAT	7 (6x - 2400 Y - 12 - 44 = 0011 - 12 - 14 / - F.6 - 2)	2 2	37.4
WRITE(3.506)((LBPL.LbDDY.K), K=I.NSPC) FORMAT(6X.5HDDYS=*8(AI.A3.12).AI.2(/5X.IH*.IX,8(A3.I2.AI))) WRITE(3.510) FORMAT(6X.3HDDYSYSU=(DYS/YS)**2) FORMAT(6X.3HDDYSYSU=(DYS/YS)**2) WRITE(3.518)K*K*K*K*K*K*K*K*K*K*K*K*K*K*K*K*K*K*K*	LEDDY	33HDDY	2 2	375
FURMAT(6X,5HDDYS=,8(AI,4A3,I2),AI,2(/5X,IH*,IX,8(A3,I2,AI))) MAIN WRITE(3,5I0) FORMAT(6X,1BHDYSYSU=(DYS/YS)**Z) UU 5I5 K=1,NSPC WRITE(3,5I8)K,K,K,K,K,K,K,K,K,K,K,K,K,K,K,K,K,K,K,	WRITE	(3.506) ((LBPL+L600Y+K)+K=I+NSPC)	2 2	27.0
WRITE(3+510) FORMAT(6X*1BHDYSYSU=(DYS/YS)**2) WD 515 K=1*NSPC WD 515 K=1*NSPC WHITE(3+518)K+K+K+K+K+K+K+K+K+K+K+K+K+K+K+K+K+K+K+	506 FURMAT	(6X,5HDDYS=,8(AI,A3,I2),AI,2(/5X,IH*,IX,8(A3,I2,AI))))	MAIN	378
FORMAI (6X,1BHDYSYSU=(DYS/YS)**2 )  DU 515 K=1,NSPC  WHITE (3,518) K*6.K*6.K*6  CONTINUE FURMAI (6X,3HDDX.12,5H=(DDY.12,7H-2.0*UY.12,13H*UYS/YS+2.0*Y, MAIN FURMAI (6X,3HDDX.12,5H=(DDY.12,7H-2.0*UY,12,13H*UYS/YS+2.0*Y, MAIN FURMAI (6X,3HDDX.12,5H=(DDY.12,7H-2.0*UY,12,13H*UYS/YS+2.0*Y, MAIN LBUVD=4H*UND LBUX=2HDX LBUX=2HDX LBUX=2HDX LBUX=2HDX LBUX=2HDX LBUX=3H*VD MAIN MAIN FURMAI (6X,4HDSUM:12:1H=,2(AI.A2:12:4A;2I2:2H)); ) FURMAI (6X,4HDSUM:12:1H=,2(AI.A2:12:4A;2I2:4I)); ) MAIN MAIN FURMAI (6X,4HDSUM:12:1H=,2(AI.A2:12:4A;2I2:4I)); ) FURMAI (6X,4HDSUM:12:1B*A4;2I2:4AI); ) MAIN MAIN FURMECA:10 GO TO 537 FURMAIN MAIN FURMECA:10 GO TO 537 FURMAIN FURMAIN FURMECA:10 GO TO 537 FURMAIN FU	WRITE	3,510)	MAIN	379
DU 515 K=1.NSPC  WAINE CONTINUE FURMATICA.3HDDX.12.5H=(DDY.12.0#UY.12.13H*UYS/YS+2.0*Y. MAIN FURMATICA.3HDDX.12.5H=(DDY.12.7H-2.0*UY.12.13H*UYS/YS+2.0*Y. MAIN FURMATICA.3HDDX.12.5H=(DDY.12.7YS)/YS)  LUDX=2HDX LUDX=2H	510 FORMAT	(6X+IBHDYSYSU=(DYS/YS)**2)	MAIN	380
WAITE (3.518) K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.	00 515	. K=1•NSPC	MAIN	381
CONTINUE CUNTINUE FURMATI(6X,3HDDX,I2,5H=(DDY,I2,7H-2,0*UY,I2,I3H*UYS/YS+2,0*Y, MAIN FURMATI(6X,3HDDX,I2,5H=(DDY,I2,7H-2,0*UY,I2,I3H*UYS/YS+2,0*Y, MAIN LBDX=2HDX LBDX=2HDX LBVD=3H*VD LBVD=3H*VD LBVD=3H*VD LBX=1HX K= I WRITE(3,532)K,((LHPL*LBDX*,J*LBVU*K,J*LHPL*LBX*,J*LBDVD*K,J),J=2, MAIN * NSPC) FURMATI(6X,4HDSUM*I2*,IH=*2(AI*A2*,I2*A1*,I2*A4*2I2)*AI, MAIN * 9(X5X*,IH*,IX*2(A2*,I2*AI*12*A4*2I2*AI))) LCOADFX3 DO 535 K=2*NM MAIN **N=K-I	WRITE	3.5I8)K*K*K*K*	MAIN	382
F UMMAT (6X,3HDDX,1Z,5H=(DDY,1Z,7H-2,0*UY,1Z,13H*UYS/YS,2,0*Y, MAIN  * I2,9H*DYSYSQ-Y,1Z,1ZH*DDYS/YS,7YS,7S,7  LBDX=2H*DX  LBVD=4H*DVD  LBVD=3H*VD  LBVD=4H*DVD  LBX=1HX  K= I  WRITE (3,532)K,((LHPL*LBDX,J*LBVD*K,J*LBUVD*K,J),J=2, MAIN  * NSPC)  * NAIN  * NSPC)  * NSPC)  * NAIN  * NSPC)  * NAIN  * NAIN  * NSPC)  * NAIN  * NAI	SIS CONTIN	100	MAIN	383
# 12.9H*DYSYSG-Y:12:12H*DDYS/YS)/YS ) ## 12.9H*DYSYSG-Y:12:12H*DDYS/YS)/YS ) ## 12.9H*DYD ## 12.9H*DY ##	PIS FURMAT	(6X,3HDDX,12,5H=(DDY,12,7H-2,0*UY,12,13H*UYS/YS+2,0*Y,	MAIN	384
LBDX=2HDX LBVD=3H*VD LBVD=3H*VD LBX=1HX LBX=1HX K=I WRITE(3.532)K.((LBDX,J.LBVV.K.J.LBPL.LBX,J.LBDVD.K.J).J=2. MAIN * NSPC) * NSPC	16421 .	*DYSYSQ-Y•I2•12H*DDYS/YS//YS )	MAIN	385
LBVD=5H*VD LBVD=5H*VD LBVD=4H*DVD LBX=IHX K=I K=I WRITE(3.532)K.((LBPL.LBDX.J.LBVV.K.J.LBDVD.K.J).J=2. MAIN * NSPC) * NSPC) * V(/5X.4HDSUM.I2.IH=,2(AI.A2.I2.A3.2I2.2AI.I2.A4.2I2).AI. MAIN * 9(/5X.4H**IX.2(A2.I2.A3.2I2.AI.I2.A4.2I2.AI)) ) IF (NM*.E0.I) 60 TO 537 NO 535 K=2.NM MAIN * N=K-I	CHUX=2	HÜX	MAIN	386
LBX-1HX K=1 K=1 WRITE(3.532)K.((LMPL.LBDX.J.LBVV.K.J.LHPL.LBX.J.LBDVD.K.J).J=2. MAIN WRITE(3.532)K.((LMPL.LBDX.J.LBVV.K.J.LHPL.LBX.J.LBDVD.K.J).J=2. MAIN * NSPC) * NSPC) * V(XX.4HDSUM.I2.IH=,2(AI.A2.I2.A3.2I2.2AI.I2.A4.2I2).AI. MAIN * 9(/5X.1H*.IX.2(A2.I2.A3.2I2.2AI.I2.A4.2I2.AI)) ) * 1F(NM.EG.I) 60 TO 537 * NAIN * NAIN * NAIN * MAIN			ZIV	387
LBA=1HX K=1 WAIN K=1 WAIN WAITE(3+532)K,((LBPL+LBDX+J+LBVU+K+J+LBX+J+LBUVD+K+J),J=2. MAIN WAINE(SPC) FURMAT(6X+4HDSUM+12+1H=+2(A1+A2+12+A3+212+2A1+12+A4+212)+A1+ MAIN FURMAT(6X+4HDSUM+12+1A++12+A3+212+2A1+12+A4+212+A1+1)) IF (NM+EQ-1)GO TO 537 NO 535 K=2+NM MAIN MAIN MAIN			NAM	388
MAIN WRITE(3,532)K,((LMPL,LBDX,J,LBVU,K,J,LHPL,LBX,J,LBUVD,K,J),J=2, MAIN * NSPC) FURMAT(6X,4HDSUM,I2,IH=,2(AI,A2,I2,A3,2I2,2AI,I2,A4,2I2),AI, * 9(/5X,IH*,IX,2(A2,IZ,A3,2I2,2AI,I2,A4,2I2,AI)) ) IF(NM,EQ,I)GO TO 537 NO 535 K=2,NM KN=K-I	רפעבוע	×	ZIAM	389
*** **********************************	T I I		ZIAN	390
# MAIN # W(ZX,1H*,1X,2(A2,1Z,4A1,1Z,4A4,2IZ),4A1, # MAIN # W(ZX,1H*,1X,2(A2,1Z,4A1,1Z,4A1,2IZ,4A1)) )	MKI IE	3.5321K.((LAPL.LBDX.J.LBVD.K.J.LBPL.LBX.J.LBDVD.K.J).J=2	ZIVW	39 I
# 9(75x+1H*2004+1Z*1C*1H*201C*1Z*1C*2H*1Z*2A4+2Z;2)*A]* MAIN # 9(75x+1H*1X*2(A2*1Z*A)+2Z*2A *1Z*A4+2Z;2*A]) ) IF (NM*E0*I) 60 TO 537 UO 535 K=2*NM		The state of the s	Z	392
MAIN LOAUFX3 MAIN MAIN		ON THE PROPERTY OF THE PROPERT	Z	393
LOADF X3 MAIN MAIN	XC/) 6 *	*! **! **  *		364
ZIV	• WN LT	K=3 NW		n
NIAM	100 000 100 100 100 100 100 100 100 100		MAIN	395
			2	396

<u>α</u>	PROGRAM LOADF	ADF 76/76	OPT=I HOUND=+-*/ IHACE	FTN 4.8+498	04/15/80	14.10.20	PAGE
007		WHITE (3.532)	Ke CO HPI of BOX - 101 HVI - 10K - 1 HVI - 1 HV	A STATE OF S		900	
		* • ( (I RPL • I RD.	• (   PP  -   FDX =   -   TVU =   F =   -   FDX =   -   -   -   -   -   -   -   -   -	- Jake NopC		366	
	535	CONTINUE		10 1011		667	
	527	TINI LUCO			3	001	1
		20 0 0 0 0 0	3		LUAUF A 3	<b>t</b>	
70.		ENGINE OFFICE			MAIN	401	
1		WK116 (3+042)	というとうとうとこれでしていまりのでは、これには、これには、これには、これには、これには、これには、これには、これに		ZIV	405	
	240	CONTINUE			MAIN	403	
	245		*2HDB . IZ . IH= . I PE IZ . 4 . 4 H . (DX . IZ . 4 H . SUM . IZ . 2 H . X . IZ	10 I2 02H+X 0 I2 0	MAIN	707	
		* SH*DSUM, I2+	I2•IH) )		MATA	405	
			Σ.		MATA	707	
017		THE CASE OF THE	× × × ×			904	
	744	CONTINE			2 2	104	
	26.4	FOUNT (AY OH	10.10.10.10.00.00.00.00.00.00.00.00.00.0	í	2 2	£0.5	
	2	100 TTO 711	• ZUDI • 12 • 12 • 12 • Z • C • 13 • C • 12 • Z • Z • Z • Z • Z • Z • Z • Z • Z •	•12)	Z	604	
		MN	Σ		ZIV	410	
3.	L	WKI IE (3.552)	527 (K+L=1+7)		MAIN	411	
<u>د ا</u> د	050				MAIN	412	
	555		,4HOFAC,12,1H=,2HDT,12,2H/B,12,2H-T,12,3H*DB,1	2,3H*D8,I2,	MAIN	413	
		* 3H/(B,12,2H	,2H*B,IZ,IH) )		MAIN	414	
		00 590 K=I,NM	Σ		MAIN	415	
		WKITE (3+592) K	92)K•K•K•K•K		MAIN	914	
02+	290	CONTINUE			MAIN	417	
	265	FURMAT (6X, 2HD	, 2HDV, I 2,5H=DFAC, I 2,3H*UX, I 2,4H+FAC, I 2,4H*DDX, I	2.4H*DDX.I2)	MAIN	614	
		DU 595 K=I,NM			MATA	610	
		WRITE (3.598) K	981K • K • K • K • K		ZIV	611	
	595	CONTINUE				200	
56	00°C	FOUNT (6X - 340)	FOUNATION TO SHEDWING TO SHEDWILL TO SHEW ITS SHEW ITS		2 7	124	
1		WINDER NING	00 * 1 E * 511 - 00 * 1 E * E11 * * 1 E * E11 * 0 * 1 E * 51 * 51 * 51 * 51 * 51 * 51 * 5	121400-	2 7	224	
		WOLLTE (3, BOS)	AND THE WOOD THE IN TOUR		2 :	463	
	RAS	FORMAT (AV. DUN	MAILE (Stoughingher) (LEBM+LBDUV+N) + N=1+NM) FORMATICK - SHOW TO TO THE CAR AS TO AT DAKE AND	,	Z	727	
	200	TOTAL CANADA	JUV*12*10=*6(A1*A3*12)*A1*2(/3/*1M**1	• T X •	Z	425	
0.0		OC STO NET ALC			ZIV	456	
20		SNOTE CAPTOR	י אר ני		ZIV	427	
	3	CONTINUE	4.4.4		NAM	428	
	010	CONTINUE			ZIV	624	
	210	TOLONAL TOLONA	*IOUDKHOV(IOI+*IC*&F) =CFT*OV*IC*/H+KH*DOV*IS)	*DUV•12)	MAIN	4 30	
o C	ر ا	****			MAIN	431	
55	ب ر	اسا	DERIVALIVES.		MAIN	432	
	د	*****	****		MAIN	433	
	1	WRITE (3,612)			MAIN	434	
	612	FURMAT (IHC . ZX	C.2X.26HFIND THE TIME DERIVATIVES.)		MAIN	435	
		WRITE (3.622)			ZIV	436	
0.3	220	FURMAT (6X+15H	*ISHSP#ASP*TIME)		MAIN	437	
					ZIV	438	
	900				MAIN	436	
	829	FURMAT (IA BHI	• 3HI 00 • 2X • 8HCONTINUE)		MAIN	055	
U.	423	FOUND 1 12 V 2011			MAIN	I 55	
1	250	TINCY (AD I MEND'S	*ZOHIFINPDE.EU.NPDEJGU IO 150)		ZIV	244	
	764	FOUNT AKY DUD	NE N		NAIN	643	
	0.30	TMCDH-TMV VDIN	CONTINUE DE CONTIN		NAIN	5 5 5 5	
		WHITE (3.638) I	A LA LA COH		MAIN	445	
50	638		4HDY==-1PEZ0-10-16H*D#HDV (1ST+KP).F1		2 4 5	440	
	1	NET TE (3.6.4.4.2)			7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	- + +	
	249	FURMAT (6X . 23H)	23HFVAL = SP*UPH (KPDF) + (17+RY)			£ 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	
					NATA	* u	
	949		KHRE TURN)			104	
55	J	WHITE (3,648)			ZAM	I C 47	
	648	FURMAT (IX , 3HI	3HISO.2X. HHCONTINUE)			254	
	,		1 TO 1 T 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		MALZ	473	

	PROGRAM 1 DADE	F 76/76	9PT=	1 80	OPI=1 KOUND=+-*/ IMACE	1 /*	~ ACE	FIN	FIN 4.8+498	464	04/15/80	14.10.20
			,									
		MN 450 K=1 ANM	-								MAIN	424
		##1TF (3.652) K.K	¥								MAIN	455
	450	CONTINE									MAIN	456
077	650	FORMAT (6X 2 2 HILLS 12 4 SHELIPH ( 12 1 1 H)	111.12.	SHELL	PH(.12	· IH	•				MAIN	457
204	360	Lacin Carried	14.0								MAIN	458
		I HODESHOD									MAIN	459
		WOLTE (3.4551K. ( (LHM.LHDU. J. J=1.NM)	H	N.	00.00	J=1.	(M)				MAIN	460
	454	FORMAT (6x - 2H011-17-1H= -8 (A1-A2-1Z) - A1-2 (/5x - 1H+ -1 X - 8 (A2-1Z-A1))	11.12	HH	8 (A 1 . A.	2,145	) . AI . 2 ( /5X .	1H*,1X	.8 (A2	((IA.51))	MAIN	461
465		VHUZE CASACO	MACHA			ı					MAIN	794
ì	649	FURMAT (6X.3HTL=+IPE20.10+1H*)	dI.=	£20.	10.1H*	•					MAIN	463
		WPITE (3.664)	1								MAIN	494
	444	FORMAT (SX.114.1X.4)14(DRHLM(IC) *UPH(NPUE) *WHLM(IC) *UPH2(NPUE))	4.1X.4	1H (D	RHLMCI	() *U	PH (NPUE) +KH	LM(1C)	*UPH2	(NPDE))	MAIN	465
		EE			1	ı					NAM	466
0.70		I BC-6HC (ICT+									MAIN	467
2		LECTION 101) *RHUV (1S1	T) ACH	ST							MAIN	468
		WRITE (3,668) TMSPH; ((LBBL, LBPL, LHC, K, LBRHUV, LBPL, K, LBP), K=I,	HdVM.	CILB	BL.LBP	LILIN	C.K.LBRHUV.	LBPL .K	·LBP)	• K=I •	MAIN	694
		# NSPC1 - I RP	)		<b>I</b>						MAIN	0.4
	944 848	FORMAT (6X.4HTD=1PE20.10.12H*UPH(NPDE) * (.2A1.46.12.410.41.12.	D==0	PE20	10,12	H*UF!	H (NPDE) * (+2	AlsA6.	I2, AI	0.A1,12,	MAIN	471
475		* 341 10 (/5x 1 H* 1 X 2 (46) [2 4 4 1 9 1 2 3 4 1))	Heelx	•2(∆	6,12,A	10.A	1,12,341))	_			MAIN	472
		TMSTP=TMN/TPN									NAIN	473
		LHK=2HG									NAIN	717
		HHERE STA									MAIN	475
		WRITE (3.672) IMSIP. ((LBBL, LBPL, LHH, K, LBH, K, LBP), K=I, NSPC), LBP	MSTP.	CLB	BL . L BP	LILE	X*X*LBH*X*L	BP) , K=	I NSP	C) • LBP	MAIN	476
480	672	FORMAT (6x,4HTR=-, IPE20, 10,2H* (,2(2A1,A2,12,A8,12,A1),2A1	R= I	PEZO	.10.2H	76)*	(2A1, A2, 12.	A8 , 12 ,	A1) +2	Al.	MAIN	477
)		* 9(/5x, IH*, IX, 2(A2, I2, A8, 12, 3AI))	. 2 (A2	,12,	A8, 12,	3AI).	•				MAIN	478
		WRITE (3.676)									MAIN	614
	474	FORMAT (6X, 35HF VAL=SP*UPH (NPDE) + (TL+TR+TD) /CM(IC)	IF VAL=	Sp*U	DH (NPD)	E) + (3	TL+TR+TD)/C	M(IC)	_		MAIN	480
		STOP									MAIN	481
485		END									NIAM	785

	S C 0 P	E 2 L 0 A	U M A P		LOADER	R VERSION	1.0 04/15/80	14.10.30. PAGE	
PROGRAM	WILL BE	ENTFRED AT	LOADF	241)	SCM LENGTH	ENGTH	15234 L	LCM LENGTH	
	BLOCK	ADDRESS	LENGTH	+ ILE					
	LOADF		10331	097					
	/STP.END/		3 P	SI -FINLIB					
	/08.IO./		144	SL-F TNLIB					
	OZNTRY=	10636	40	SL-FINLIB SL-FINLIB					
	FECMSK=	10652	17	SL-F TNLIB					
	FEIFST=	10713		SL -F INLIE					
	FL 1 IN=	11074	315	SL-F TNLIB					
	FMTAP=	11411	377	SL-F TNLIB					
	FORSYS=	12010	300	SL-F TNLIB					
	F ORUL =	12355	տ Գ Մ	SL-F INLIB					
	INCOM	12431	144	SL-FINLIB					
1	INPC=	12575	173	SL-FTNLIB					
.27	KODER=	12770	476	SL-FINLIB					
7	OUTCE	14142	155	SL-F TNL18					
	OUTCOM=	14317	504	SL -F TNL IB					
	ERRCAP=	14523	317	SL-FTNL18					
	FERCAP= SYSAID=	15233	1.1	SL-FINLIB					
_	45	2.00							
•									
.31001901E+01 87738042E+03 .55210391E-08	1 1	.51119464E-03 19629421E+01 18122739E-11 -	.52644210E-07 .30574451E+01 .98890474E+03	-0734909973E-10 +01 .26765200E-02 +0322997056E+01	73E-10	H H H S			
2	N N	28.00							
9058631 905861 632175 632175 LEAST LEAST LEAST	-28963194E+01 .15154866 90586184E+03 .61615148 63217559E-0922577253 VISCOSITY FROM WARNATZ LEAST SUUARES FIT: T=3 THERMAL CONDUCTIVITIES LEAST SOUARES FIT: T=3	E + 01 ST P P P P P P P P P P P P P P P P P P P	57235277E 36748261E 10611588E RNATZ ST	-06 .99807393E-10 +0112081500E-02 +04 .23580424E+01	03E-1065223555E-14 00E-02 .23240102E-05 24E+01	~ ~ ~ 2 Z Z			
	25	2.188700E-06	6 6.5U290UE	E-01 H2	VISCOSITY.				
-	45	6.357900E-06	6 7.383300E	E-01 H2	THERMAL CONDUCTIVITY	٦٢.			
2	27	4.266700£-06	6 6.613600L	L-01 N2	vISCOSITY.				
~	N Z	6.407700E-07	7 7.999600E-01	E-01 N2	THERMAL COMBUCTIVITY	14.			

BINARY DIFFUSION COEFFICIENTS FROM WARDATZ ST PAR. LEAST SGUARES FIT: T=300,2000.

-	N	2 H2 N2	~ 2	5.951700E-05	5.951700E-US 1.663800t+00 HZ	Яζ	N2	HINARY DIFFUSION.	
<b>~</b> :	2	N	N	1.5374006-05	1.537400E-US 1.672900E+00 N2	28	N2	HINARY DIFFUSION.	
II NGL	IPN = 1.0000E + 03	5+03	PHN	PHN = 5.0000E-05	TMN = 1.0000E-03	) 3			

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                                                                                                                                                                                                                                                                                                                                    1.0000E-03
                                                                                                                                                                                                                                                                                                                                                                                                                                                                             = -2.79550381E+04*(T**( -2.66380000E+00))*UT
                                                                                                                                                                                                                                                                                                                                                                             4.69422831E-06*(T**( -2.6167000E-01))*DT
5.12590369E-07*(T**( -2.0004000E-01))*DT
                                                                                                                                                                                                                                                                                                                                                                                                                                  DVL 1= -1.16127967E+U5*(T**( -1.7383300UE+00))*DT
DVL 2= -1.24843548E+U6*(T**( -1.799960UE+U0))*DT
                                                                                   BINARY DIFFUSION CUEFFICIENTS FROM WARNATZ ST PAR.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 1.68019221E+04*(T**( -1.66380000E+00))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     0LSUM=+X 1*0RL 1+0X 1*RL 1+X 2*∪⊩L 2+∪X 2*RL 2
0LS1V=+0X 1*VL 1+X 1*0VL 1+0X 2*VL 2+X 2*∪VL 2
                                                                                                                                                                                                                                                                                                                                                                                                         1.57284638E+05*(T**( -7.34330000E-01))
1.56062238E+06*(T**( -7.99960000E-01))
                                                                                                                             U 1 2= 5.95170000E-05*(T** 1.65380000E+00)
                                                                                                                                                                                                                                                                                                                                                                1.2187690433E-02*(DT/T+DYS/YS)/(T*YS)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   DLSUM=+X 1*DRL 1+DX 1*RL 1+X 2*UFL 2+DX 2*RL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     AVERAGE OF LINEAR AND RECIPROCAL MIXING RULES.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         SPECIFIC HEAT OF THE MIXTURE. NTIS FORMULA.
THE KMAL CONDUCTIVITIES FROM #ARNATZ ST PAR. LEAST SQUARES FIT, T=300,2000.
V l= 2.188700E-06*(1** 6.502910E-01)
                                                      RL 1= 6.357900E-06*(T** 7.383300E-01)
                                                                        6.407700E-07*(T** 7.999600E-01)
                                          6.613600E-01)
                                                                                                                                                                                                                                                                                                                                    5.0000E-05
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        SPACE DER OF DENSITY TIMES THERMAL COND.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            CM(1C)=+C(1ST+ 1)*U 1+C(1ST+ 2)*U 2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        THERMAL CONDUCTIVITY OF THE MIXTURE.
                                                                                                 LEAST SQUARES FIT, T=300,2000.
PRESS = 1.00
                                                                                                                                                                                                                                                                                                                                   PHN II
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 SUM 1=+X 2*VD 1 2
H 1=X 1*SUM 1* 5.0000E-05
                                                                                                                                                                                                                                                                                                                                                 DT=UPH(NPDE) # 1,0000E+03
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          URHLM (1C) = DRH*RLM+RH*DRLM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    RLSUM=+X 1*RL 1+X 2*RL 2
RLSIV=+X 1*VL 1+X 2*VL 2
                                           4.266700E-06#(1##
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               DLS1V=-RLS1V*RLS1V*ULS1V
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                RLS1V=+X 1*VL 1+X 2*VL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              DRLM=0.5* (DLSUM+ULS1v)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            RLM=0.5* (RLSUM+RLS1V)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       DX 1=DY 1/YS-Y 1*DYSY
DX 2=DY 2/YS-Y 2*DYSY
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      H 1=X 1*SUM 1* 5
T 1=-RH*(1.0-U 1)
                                                                                                                                                                                                                                                                                                       DY 2=0U 2/ 28.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        DYSY=DYS/(YS*YS)
                                                                                                                                           SPACE DERIVATIVES.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                RLS1V=1.0/RLS1V
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           RHLM (1C) = RH*RLM
                                                                                                                                                                                                                                                                                                                                  1.0000E+03
                                                                                                                                                                                                                                                                                                                    UYS=+DY 1+DY 2
                                                                                                                                                                                                                               DDU 1=UPH2( 1)
                                                                                                                                                                                                                                                                           000 2=-000 1
                                                                                                                                                                                                                   DU 1=UPH( 1)
                                                                                                                                                                                                                                                                                           DY 1=0U 1/
                                                                                                                  1.00
                                                                                                                                                                                       X 2=Y 2/YS
                                                                                                                                                                                                                                                U 2=1.0-U
                                                                                                                                                                         X 1=Y 1/YS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         SULVE FOR UV.
                                                                                                                                                                                                                                                              00 2=-00 1
                                                                                                                                                                                                     U 1=U( 1)
                                                                                                                                                             Y5=Y 3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                             DVD 1
                                                                                                                                                                                                                                                                                                                                  Zd L
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* TADE 3. TADE 0. TADE 1 5.1		MANTER
C LOADS COCATEC THE CHARMITTAE & IN CLEAN	HADRITTAE F IN FLOY	
	1000011112 1 11 1 1000	
		Z
		ZIVE
	LB(25) +# (25) +AU(7+25) +AL(7+25)	MAIN
	16	MAIN
		MAIN
	ALD (25) +BLU (25) +ABO (25+25) +BBU (25+25)	MAIN
	8V (25)	MAIN
		MAIN
DIMENSION	SG4 (25) + UM (25) + ALP (25)	MAIN
C BOLTZMAN CONSTANT.		MAIN
RK=1.38054E-16		MAIN
WRITE (3,1000)		MAIN
1000 FORMAT(1HC+2X+63H	FORMAT (INC. 2X. 63HFUH THE COMPLETE TRANSPURT CASE. WE DO NOT WANT T	
۰		
WRITE (3+1005)		MATA
1005 FORMAT(1HC, 2X, 62H	FORMAT (IMC. 2X. 62HTHEIR FIRST DEMINATIVES TO BE ZERO. THIS CAN LEA	
*D TO DIVISION		
WRITE (3.1010)		MATA
1010 FORMAT(1HC.2X.8HBY ZERO.)	Y ZERO.)	MATA
		MATAN
1012 FURMAT(6X+14HD0 S K=1+NPDEM)	K=1.NPDEM)	Z Z
		MATA
1014 FURMAT (6X. 32HIF (A	FURMAT (6x+32HIF (AHS (U(K)) - IT - SHALL ) U(K) = SMALL )	MAIN
		MAIN
1016 FORMAT(1X,1H5,4X)	FORMAT(1X.1H5.4X.36HIF (ABS(UPH(K)),LT.SMALL)UPH(K)=SMALL)	MAIN
		MAIN
FOF		MAIN
C NLINE IS THE NUMBER (	IS THE NUMBER OF COMMENT LINES TO BE READ AND PRINTED.	MAIN
00 20 K=1 NLINE		MAIN
READ (5, 22) 11		MAIN
		MAIN
CONTINUE		MAIN
		MAIN
C4 FURMATION TEAL		MAIN
MEAD (S. 12) NSPC		MAIN
NM=NSPC-1		ZIAM
LBM=1H-		NAIN
LBU=2HU(		MAIN
L8P=1H)		MAIN
	WHITE(3:1020) ((LBM.LBU.K.LBP).K=1.NM)	MAIN
1020 FURMAT (6X,6HYN=1.0	F UMMAT (6X+6HYN=1.0+8 (A1+A2+12+A1)+A1+2(/5X+1H++1X+	MAIN
. B(A2,12,A1,A1))		MAIN
		MAIN
1025 FURMAT (6X+33HCALL	FURMAT (6X.33HCALL HT (U.YN.R.NPUE.KPUE.IC.KSKR) )	MAIN
		MAIN
18 FORMAT (6X + 4HIST=+ 12 + 7H* (1C-1)	(S* 7H* (IC-1) )	MAIN
00 30 K=1.NSPC		MAIN
	READ(5.32) LB(K) . LHTHU(K) . W(K) . SGA(K) . ESK(K) . UM(K) . ALP(K)	MAIN
32 F UHMAT (2A5. IPSE 12.4)		MAIN
	WHITE (6.34) K.LB (K).LOTHD (K).W (K).SGA(K).ESK (K).UM(K).ALP (K)	MAIN
	***>) . IPSE12.4/)	MAIN
COMPUTE AN	IUN FOR THERMAL DIFFUSION FOR THOSE SPECIES	ZIV
C WITH LATHD = THUFF.		
		MAIN

		MAIN	59
			10
		MATAN	60
	READ(15,36) (AU(L,K),L=6,7), (AL(L,K),L=1,3), (III(L),L=1,5)	2 2	90
	_	2 2	10
	READ(15,37)(AL(L,K),L=4,7),(III(L),L=1,20)	2 4 4 5	20
	wRITE(6,37)(AL(L,K)+L=4,7)+(Ill(L)+L=1+20)	Z	503
	CONTINUE	N T WE	<b>t</b> 1
	FORMAT (SE15.8.5A1)	NAM	65
3.7	FORMAT (4F15.88.20A1)	MAIN	99
	WEAD 55.232 IPN. PHN.	MAIN	19
233	FOUNT ( 1935   2 - 4)	NAM	68
		MAIN	69
	FORDINATION (KRKI,GI, 1) GO TO 10 0)	MAIN	7.0
73		MAIN	1.1
	TAXLE COVER 1 TO TAX TO	MAIN	72
82	C C	Z	73
	READ(5,12) NLINE	MAIN	74
	00 40 K=1+NLINE	MATA	7.
	READ(5•22)II		7.
	WRITE (3.22) II	NI 4E	0 1
	EQUI LINOU	Z	
*		MAIN	7.8
	THAN DIES AND HEAT CAPACITIES.	ZIV	4
1 × ×	TELLICO TION CONTRACTOR OF THE	MAIN	90
		MAIN	81
	WALLE GARACE	MATA	82
45	0007 01	Z	83
	00 50 K=1 • NSPC	NAM	78
	WRITE (3,52) K.AL (1.K) .AL (2.K)	2143	u di
	WRITE (3,54) (AL (L,K),L=3,5)		9 9
	WRITE(3,62)K.AL(6,K).AL(1,K)		0 0
	WRITE (3.64) AL (2.11), AL (3.11)		- 0
	WRITE (3,66) AL (4,K), AL (5,K)	Z :	0 0
			6
55	FORMAT (6X,1HC, 12,9H=1,9872*(,1PE16,8,4H+T*(,1PE16.8)	2 2	2
54	FORMAT(5X+1H*+1X+3(4H+T*(+1PE16+8)+5H)))))		1 6
	WRITE (3,56)	2 2	200
56	FORMAT(6x,10HGO TO 3000)	ZIVE	£, 6
	WRITE (3,58)	Z	<b>3</b> C
58	FORMAT (4H2000+2X+8HCONTINUE)	Z ;	0 6
	DO 60 K=1•NSPC	2 .	6 6
	WRITE (3,52) K+AU(1+K) +AU(2+K)	ZIV	7 6
	WRITE(3+54) (AU(L+K)+L=3+5)	Z	80
	WRITE (3.62) K.AU (6.K).AU (1.K)	MAIN	66
	WHITE (3.64) AU (2.K) • AU (3.K)	MAIN	001
	WHITE (3.66) AU (4.4), AU (5.4)	MAIA	101
	CONTINUE	NAN	201
62		ZIV	501
44	FURMAT (5x,1H*,1x,4H+1*(,1PE16.8,4H/2.0,4H+T*(,1PE16.8,4H/3.0)	NAM	104
94	FOHMAT (5X*1H*1X*4H+1*(*1PE16.8*4H/4.0*4H+1*(*1PE16.8*	MAIN	105
) )	# 41/2-0-64111111	MAIN	106
	EX.1 TF (3.68)	MAIN	107
68	FURMAT (4H3000,2X,8HCONTINUE)	NAN	108
		ZIV	601
134	FURMAT(1HC.2x.33HSPECIFIC HEATS AND SPECIFIC ENTHALPIES. )	MAIN	110
}	U0 140 K=1,NSPC	MAIN	111
	*X]TE(30]40)X*K*2(X)	MAIN	112
	WILLE (30 144) Koko x (t)	Z	113
140	CONTINUE	Z	7 .
142	F DKMAT (6X . 6HC (IST + 12 · 3H) = C · 12 · 1H / · F 6 · 2)	MAIN	115

116																																									,						171	172
MAM	MAIA	MAIN	MAIN	MAIN	MAI		MAIA	MAIN	MAIN	MAIA	MAI	MAIN	MAH	2 2		Z	MAT	MAIN	MAIN	MAIN	ZIV	MAIN	MAIN	Z	Z	2 2	MAIN	MAIN	MAIN	MAIN	MAIN	Z dw	2 2	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	MA	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	2 2	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN
	• FORMAT(1X,3HI25,2X,8HCONTINUE)	THERMAL CONDUCTIVITIES AND BINARY DIFFUSION COEFFICIENTS.	COEFFICIENTS FROM A FILE CREATED BY VALUES. CY=6.		KEAD (5,12) NLINE	D	WRITE(6,22)11	WRITE(3,22)11	FORMAT(1HC,5X,1HV,12,1H=,1PE14,6,5H*(T**,1PE14,6,1H) )	READ(5,12)NLINE	DO 70 K=1+NLINE	KEAD(5,22)11	WALLE (3022) II	WRIE (6+22) II		READ (9.82) AV (K) . HV (K) . 111	WK1 TF (6 • 84 ) X • L • L • L • L • L • L • L • L • L •	READ(9,82)ALD(K), BLD(K), 111	WRITE(6,84)K,LB(K),ALD(K),BLD(K),III	CONTINUE	FORMAT(IP2E14.6.44AI)	FORMAT (/2x, I4,4x, A4,4x, IP2E14,6,44AI/)	0.0 78 K=1.NSPC	1 1 1 (	CONTINUE DO NET TREBE	EXTITE (3.90) K.A.D. (X) BLD (X)	CONTINUE	FORMAT (6X, 2HRL, 12, 1H=, 1PE 14, 6, 5H* (T**, 1PE 14, 6, 1H))	READ (5, 12) NL INE	DO 100 K=1.NLINE	READ(5,22)11	(VALLE (ACC) II	# N L   C   Q   C   J   J   C   N   C   L   C   C   D   C   C   D   C   C   C   C		DO 110 1=1.4 NSPC	DO 110 J=1.NSPC	READ(9.82) ABD(1.J) .HBD(1.J).111	WRITE(6+112)1+J+L8(1)+LB(J)+ABU(I+J)+BBU(I+J)+111	CONTINUE	T ORMAT (/2x, I4,4x,14,4x,14,4x,44,4x,1PZE14,6,44AI/)	FAUL (5-114) PRESS	EXTITE (A. 1.4.) DDF CC	FORMAT(IMC,2X,7HPKESS =+F6.2)		I+I=dI	00 120 J=1P•NSPC	AHI) (1.0) = AHD (1.0) / PRESS	**************************************
144	146 C	O C	ی د	ပ				72	19					7.0	-					80	85	78		10	ž.		06	36					0	•					110	112	11,	1	116					
115		961	150			125					130				1 25	101				140				7.0	143				150				155	1				160				165					170	

<u>.</u>	PROGRAM LOADF 76/76	OPT=1 KOUND=+-*/ THACE FIN 4.	0 864+8°	04/15/80	13.55.29
	120 CUNTINUE 122 FURMAT(1HC.5	CONTINUE FURMAT(1HC,5X*1HU*212*1H=*1PE14.6*5H*(1***1PE14.6*1H)	î	MAM	173
175	READ(5,279)4 WRITE(6,123)	KEAD(5,279)ARTP.CKTP.III WRITE(6,123)ARTP.CKTP.III		M M M M M M M M M M M M M M M M M M M	176
		NRINE (6.123) ACST-CCST-111 PRINE (6.123) ACST-CCST-111 FORMAT (1P2F 14.6.44A1)		MAIN	178 179
001	*	P2E 4.6944A])		MAIN	180
0	Q #	E.S. ******		MAIN MAIN	162 183
				MAIN	184 185
185	148 FORMAT (1HC+2X+18HSPACE NS=NSPC+1	X*18HSPACE DERIVATIVES.)		MAIN	186 187
	WRITE (3.149) NS 149 FORMAT (6X,4HYS=Y	NS 175=7•12)		M M M M M M M M M M M M M M M M M M M	188
190		15PC **		2 Z Z Z	191
	150 CONTINUE 152 FORMAT(6X+1HX+1	1X,12,2H=Y,12,3H/YS)		M M M	193
	UO 160 K=1.NM WRITE (3.162)K+K	Σ Υ - Υ••		Z Z Z	195
195	WR1TE (3+164)K+K WR1TE (3+166)K+K	<b>大</b> ★ ★ 大 本 ★ ★ ★		ZZZ	197
		10.12.3H=U(.12.1H))		Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	198
Ċ	164 FORMAT (6X,2H	FORMAT (6X,2HDU,12,5H=UPH(+12+1H))		M M M M M M M M M M M M M M M M M M M	200
000		MINITED TO THE PROPERTY OF THE		MAIN	202
	WKITE (3+172) 172 FORMAT (6X+114)	FORMET (6x+1/2) N3FC+ (LEM+LBOVE) FN-1+1NH) FORMET (6x+1H4+1Z+4H=1+0+8 (A1+A1+1Z)+A1+2 (/5x+1H4+1X+	•	MAIN	100 400 80
502	* 8(AI•12•AI LBDU=2HDU			M N	506
	WRITE (3.174)NSPC.	PRITE(3,174)NSPC.((LBM.LBDU.K).K=1.NM) FORMAT(6X.2HDI.12.1H=.8(A1.42.12).A1.2(/SX.1H*.1X.		M M M M I N I N I	<b>207</b> 208
	*			M M M	209
210	LB000=34000 WR11E(3+176)	LBUDU=37000 WRITE(3,176)NSPC.((LBM,LBUDU,K).k=1,NM)		MAIN	211
	176 FORMAT (6X,3H	1000.12.1H=.8(A].A3.I<).A].2(/5X.1H*.1X.		Z Z V Z V Z	212 213
	DO 180 F=1+NSPC EDITE(1)+1E0)XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	10 PC		N M M	214 215
215	180 CONTINUE			MAIN	216
		FORMAT(6X*2HDY,1Z,3H=DU,1Z,1H/,F6.2)   BOX=2HDY		ZZZ	218
		(	2.4111.1	NAM	219
220	186 FURMAT (0X.4HUTS=+8 (AI.4A PSK=PRESS/82.05		C1 H111 1	MAIN	221
		NW L		ZZZ	22 <b>2</b> 223
	234 FORMAT(1HC+2X+5HTPN + 5HTMN =+1PE12+4)	=.1PE12.4.6A.5HPHN =.1PE12.4.6X	•	Z Z Z	225
552	WHITE (3,226) TPN	WHITE (3.226) TON FORMATERS, 13HOT=UPH (NPDF) #. TPF 1/24)		MA I A	226
		TOTAL		ZZ	228 228
	227 FUHMAT (6X.15	SHOCH HOMBE CATOES * THE IZ * 5		2 4 4	653

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		2 2 2 2 2 2 4 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6					265 266 267 268 268			283 244 245 286
A A A A A A A A A A A A A A A A A A A	A H H H H	H H H H H H H H H H H H H H H H H H H	H H H H H H H H H H H H H H H H H H H	A H H H H H H H H H H H H H H H H H H H	A H H H H H H H H H H H H H H H H H H H	H H H H H H H H H H H H H H H H H H H	M M M M M M M M M M M M M M M M M M M	N N N N N N N N N N N N N N N N N N N		2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
WRITE(3,242)PSR FORMAT(6x,5HDRH=-,1PE18,10,21H*(UT/T+UYS/YS)/(T*YS)) DU 807 K=1,NSPC A=1,0/ALD(K) B=-RLD(K)			A=1.0/ALU(K) B=-BLD(K) A=A*B B=B-1.0 WRI-1.0	CONTINUE FORMAT (6X,3HDVL,12,1H=,1PE14,6,6H*(T**(,1PE14,6,5H))*DT ) WRITE (3,745) FORMAT (6X,16HDYSY=DYS/(YS*YS) ) DO 750 K=1,NSPC	CONTINUE FORMAT(6X*2HDX*12*3H=DY*12*5H/YS-Y*12*5H*UYSY ) DO 500 K=1*NSPC WRITE (3*502) K*K**(K)	CONTINUE FORMAT(6X,3HDDY,12,4H=DDU,12,1H/,F6,2) LBUDY=3HDDY WRITE(3,506)((LBPL,LBDDY,K),K=1,NSPC) FORMAT(6X,5HDDYS=*8(A1,A3,12),A1,2(/5X,1H*,1X,8(A3,12,A1)))	WRITE (3,510) FORMAT (6x,18HDYSYSQ=(DYS/YS) **2) DO 515 K=1,NSPC WRITE (3,518) K*K*K*K CONTINUE	F DKMA I (SX.4HDDX.1Z.5)H= (DDY.1Z.7H=Z.0*DY.1Z.13H*DYS/YS+2.0*Y. * IZ.9H*DYSYSQ-Y.1Z.1ZH*DDYS/YS)/YS	H=-BBD(1,4) WHITE(3,618)1,J,A,B CONTINUE FORMAT(6X,2HVD,212,1H=,1PE16,8,6H*(T**(,1PE16,8,2H)) ) DO BZO J=1,NSPC DO BZO J=1,NSPC IF(I=E0,J)GO TO BZU	A=1.0/ABU(I.J) K=-BBD(I.J) A=A*K H=H-1.0
242	809	740	, P	749	750	500 50 <b>2</b> 50 <b>6</b>	510	£ 10	815 818	
230	235	240	545	250	255	260	592	270	275 280	285

PROGR	PROGRAM LOAUF 76/76 OPT=I HOUND=+-*/ THACE FIN 4.8+49H	04/15/80	13.55.29	PA
		MAIN	287	
	CONTINUE		298	
	O// FOKEAL(OX-SHDVD-Z17-17-17-17-10-0-0-07-1-**(-17-10-0-07-11)->D-)	ZIVE	289	
062		MAN	29I	
	***	MAIN	292	
	A HINDOR STAN	MAN	293	
	THE COMMENT OF THE PROPERTY OF THE PROPERTY OF THE	2 2 2	200	
295	L80=3H) *U	ZZ	296	
		MAIN	297	
	URMAT (6	NAN	298	
	* 4(/5X•I	MAIN	568	
000	**************************************	Z	300	
000	***	ZZZ	301	
	WRITE (3.	MAIN	303	
	WRITE(3,274)	NAIN	304	
305	272 FORMAT(IHC,2X,36HTHERMAL CONDUCTIVITY OF THE MIXTURE.) 27. FORMAT(IHC,2X,46HAVENAGE OF LINAED AND DECIDENCAL MIXTAG DIE E	Z Z	305	
000	LBX=IHX	ΣX	307	
	LBPL=1H+	MAIN	308	
	LBRL=3H*RL	MAIN	309	
	I		310	
310	WRITE (3,260) LBMIX+ ((LBPL+LBX+K+LRRL+K)+K=I+NSPC)	MAIN	311	
	COU FUNDATIONALIHETO(ZAITICASTIC) +AITC(/SX*IH*+IX+	Z Z	312	
	O     O     O   O   O   O   O   O   O	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	515	
	LOST INTERPORT		315	
315	WRITE (3,260) LBMIX, ((LBPL,LBX,K,LHSRL,K),K=I,NSPC)	MAN	316	
	WRITE (3,265)	MAIN	317	
	265 FORMAT(6X*JSHRLSIV=I.0/RLSIV )	MAIN	318	
		MAIN	319	
	270 FORMAT(6X*2IHRLM=0.5*(RLSUM+RLSIV))	ZIV	320	
320		2 2	321	
	JOO TOMANIONALTIMATORORY	ZZ	325	
	C DERIVATIVE OF THE THERMAL CONDUCTIVITY OF THE MIXTURE.	Z	324	
		MAIN	325	
325	WRITE (3,312)	MAIN	326	
	312 FORMAT (IHC.2X.40HSPACE DER OF DENSITY TIMES THERMAL COND.)	Z I V	327	
	LBOKL=44*0KL	2 Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	320	
	LODA:ZHUX LBMIX=SHUX	ZIV	330	
330	WRITE (3,760) LBMIX. ((LBPL.LBX.K.LHDRL.K.LBPL.LBUX.K.LBRL.K).	MAIN	331	
	* K=I*NSPC)	ZZ	332	
		Z Z Z	333	
	• A4• 12• A1• A2• 12• A3• 12• A1)	7 7 7 4 8 8	335	
335	LBMIX=SHULSIV	ZIVM	336	
	[BOVL=4H*OVL =PITE(3,745); BMIY, (1) HP; (1 HP) (1 HTX*K*) HSP[ *K*] HP; (1 HX*K*) BDV(*K)	ZZ	337	
	C)	MAIN	339	
	765 FURMAT (6X. AS. 1H=+2(41. A2. 12. A3. 12. 241. 12. A4. 12) . A1. 6(753. 1H4. 1x.	MAIA	340	
340	# 3(AP.12.4A3.12.2AI.12.44.12.41)) )		341	
	770 FORMAT(6X,24HD) SIV==#  SIV#R  SIV#3  SIV )	7 7	245 625	
	O T WILLIAM I	-	7	

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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        WHITE (3,532) K. ((L.P.L.LHDX, J.LHVD.K, J.LHPL.L.X.J.LHDVD.K.J).
                                                                                                                                                                                       WRITE(3,402)K, ((LBPL.LBX,J,LBVD,J,K),J=1,KM),((LBPL,LBX,J,
                                                                                                                     WRITE(3,402)K,((LBPL,LBX,J,LBVD,K,J),J=2,NSPC)
FURMAT(6X,3HSUM,I2,1H=,5(2A1,I2,A3,212),AI,3(/5X,IH*,IX)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                               FORMAT(IHC.2X.30HSPACE DER OF DENSITY TIMES UV.)
                                                                                                                                                                                                                                                                            FORMAT (6X, IHB, 12, 2H=X, 12, 4H*SUM, 12, IH*, 1PE12,4)
                                                                                                                                                                                                                                      WRITE (3,402)K, ((LBPL,LBX,J,LBVD,J,K),J=I,NM)
                        FORMAT(6X,25HDRHLM(IC)=DRH*RLM+H*DRLM)
                                                                                                                                                                                                                                                                                                                  FORMAT (6X, 1HT, 12, 11H=-RH* (1.0-U, 12, 1H)
                                                     ZEHO ORDEH BORIS AND OKAN APPROXIMATION.
                                                                                                                                                                                                                                                                                                                                                                                            FORMAT (6X.2HVX.12.4H=FAC.12.3H*UX.12
                                                                                                                                                                                                                                                                                                                                                                                                                                  FORMAT (6X, 3HUVX, I2, 2H=U, I2, 3H*VX. I2
       FORMAT (6X,22HDRLM=0.5* (DLSUM+DLSIV)
                                                                                                                                                                                                                                                                                                                                                       FORMAT (6X, 3HFAC, 12, 2H=T, 12, 2H/8, 12)
                                                                                                                                                                                                                                                                                                                                                                                                                                                     0.0
                                                                                FORMAT(IHC, 2X, 13HSOLVE FOR UV.)
                                                                                                                                                                                                                                                                                                                                                                                                                                                     SOLVE FOR THE SPACE DEMINATIVE OF
                                                                                                                                                                                                                                                                                                                                                                                                                                             *****
                                                                                                                                          * 5(A1,12,A3,212,A1)) )
IF(NM.EQ.1)60 TO 412
DO 410 K=2,NM
                                                                                                                                                                                                                                                                                                                                                                                                                                                               ***************
                                    ****
                                                                                                                                                                                                                                                          WRITE (3,418) K,K,K,PHN
                                                                                                                                                                                                  * LBVD,K,J),J=KP,NSPC)
                                                                                                                                                                                                                                                                                                                                                                                                                WHITE (3, 1202) K, K, K
                                                                                                                                                                                                                                                                                                                                     WP1TE (3,428)K,K,K
                                                                                                                                                                                                                                                                                                                                                                           WHITE (3,468) K+K+K
                                                                                                                                                                                                                                                                                                                                                                                                        DO 1200 K=1,NSPC
                                                                                                                                                                                                                                                                                        DO 420 K=I,NSPC
                                                                                                                                                                                                                                                                                                  WR1TE (3+422)K+K
                                                                                                                                                                                                                                                  DO 415 K=1,NSPC
                                                                                                                                                                                                                                                                                                                              DO 425 K=1,NSPC
                                                                                                                                                                                                                                                                                                                                                                 00 465 K=1,NSPC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        UND*HP=QVUHJ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                         WRITE (3.522)
WHITE (3,775)
                  WRITE (3,778)
                                                                          WRITE (3,400)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       CHVD=3H*VD
                                             SOLVE FOR UV.
                                                                                                     LBVD=3H*VD
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            LBUX=2HDX
                                                                                                                                                                                                                                                                                                            CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                      CONTINUE
                                                                                                                                                                                                             CONTINUE
                                                                                                                                                                                                                      CONTINUE
                                                                                                                                                                                                                                                                                                                                                 CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                           CONTINUE
                                                                                                                                                                                                                                                                      CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               LHX=IHX
                                                                                            LBX=IHX
                                                                                                                                                                                                                                K=NSPC
                                                                                                                                                                        スマースープ
                                                                                                                                                                                  XP=X+1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   Y
II
                                                                                                                K=1
                                                                                                                                                                                                                                                                                                                                                                                                                           1200
                                                                                                                                                                                                                                                                                                                                                                                     468
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                                                                                                                                                                                                                                                                                                                                                           380
                  345
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                                                                                                                                                                                                                                                             370
```

ADF # J=2,
2 FORMAT (6X,4HDSUM,12,1H=,2(AI,AZ,12,A3,212,2AI,12,A4,212),AI * 9(/5X,IH*,1X,2(A2,12,A3,212,2AI,12,A4,212,AI)) ) 1F (NM,E0,1) 60 T0 537 00 535 K=2,NM
rm=r-1 KPIRK*I WRJTE(3*532)K*((LBPL*LRDX*J*LBVU;J*K*LBPL*LBX*J*LBDVD*J*K), * J=I*KM)*((LBPL*LBOX*J*LBVD*K*J*LRPL* HX*J*LRDVD*K*J)*J=KP*NSPC
35 CONTINUE 37 CONTINUE 88 K=NSPC 88 WRITE (3.532) K, ((LBPL,LBDX,J,LBVD,J,K,LBPL,LBX,J,LBDVD,J,K),J=1,NM) 89 CONTINUE 80 CONT
<pre>wRITE(3,542)K,PHN,K,K,K,K 540</pre>
545 CUNTINUE 548 FURMAT(6X,2HDT,12,12H=-DRH*(1.0-U,12,7H)+KH*DU,1 DO 550 K=1,NSPC WRITE(3.552)(K,1=1.7)
CONTINUE FORMAT(6X.4HDFAC.12.1H=.2HDT.12.2H/B.12.2H-T.12.3H*DB.12 * 3H/(B.12.2H*B.12.1H) ) DO 590 K=1.NSPC WRITE(3.592) K.K.K.K.K.K
USE A BINARY APPROXIMATION FOR THEHMAL INDICATED SPECIES. ************************************
**************************************
IPL=I+1 DO 900 J=IPL+NSPC IF (LRTHD(1).NE-LHUFF.AND-LHTHU(J).NE-LHUFF)GOT090
IF (LBTHD(I) = LBDFF) IP=1  IF (LBTHD(I) = EQ_LBDFF) JP=J  IF (LBTHD(I) = NE_LBDFF) IP=J  IF (LBTHD(I) = NE_LBDFF) JP=I  E=SORT(ESK(IP) *ESK(JP))  IF (UM(IP) = EQ_0 = 0.4ND + UP(JP) + EQ_0 = 0.000 ND + UP(JP) +
SUMING AT MUST UNE POLAR IP) "NE.0.0) LP=IP

	17 (CT - CC - LD	MAIN	455
	X1 - 1.0 - ( \$ ( 0   ) \ X1   1.0 - ( 1   ) \ X	2 2 4 4 2	4 0 1 1
	SGC=SGA(LP) *1.0E-8	NAN	40.00
	TPSTAR=UMP*UMP*(FOX (TP)*RX*NGC*NGC*NGC*NGC*	NIV	0 0
	FC=1.0+(I.0/SQR1(2.0)) + (ALP(LNP) + TPSTAR/(SGA(LNP) + +3)) + SQR1(FSK)	Z	460
	* LP)/ESK(LNP))	MAIN	199
	WR1TE (6.1 305) IP. JP. LP. LNP. FC	MAIN	462
1305	5 FORMAT(/5X.416.1PE12.4)	MAIN	463
	E=E*FC*FC	ZIV	454
1302	CONTINUE	MAIN	465
	WRITE (3,903) E	MAIN	446
606	FURMAT(6X,5HTS=1/,1PE14.6)	MAIN	195
	L8RTP=3HRTP	MAIN	468
	WRITE (3,906) LBRTP, ARTP, CRTP	MAIN	694
906	FORMAT(6X, A3, 1H=.1PE14.6.5H*EXP(.1PE14.6,4H/TS))	MAIN	470
	LBC=3HCST	MAIN	47]
	WRITE(3,906)LBC,ACST,CCST	MAIN	472
	WR1TE (3+909)	MAIN	473
606	FURMAI(6x,16HCSIP=6.0+CSI-5.0)	Z	474
	((dT) s) ((dT) s) ((dT) s) ((dT) s) (dT) s (dT) s) (dT) s (dT) s (dT) s (dT) s	MAIN	475
	KRITE (3.012) ID-LD-KM	MAIN	476
912	FORMAT(6X,2HAL,212,1H=,1PE14,6,9H*RTP*CSTP)	MAIN	477
	WRITE (3,915)E	MAIN	478
915	FORMAT (6X, THDTS=DT/, 1PE14,6)	MAIN	679
	A=-ARTP*CRTP	MAIN	084
	L80RTP=4H0RTP	Z	1007
	WRITE (3.918) BORTP A CRTP	2 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	1017
918	FORMAT (6X* 44* 1H=")PE14*6*5H*EXP(*1PF14*6*16H/TS)*;;;	ZZ	707
	180C=4H0CS1	NAM	787
	A==ACS1*CCS1	Z Z Z	484
	WRITE (3,918) LBDC.A.CCST	MAIN	486
	WRITE (3+921)	MAIN	487
126	FURMAT(6x,14HDCSTP=6.0+DCST)	MAIN	488
	WRITE (3,924) IP, JP, WM		0 84
926	FORMAT (6X, 3HDAL, 212, 1H=, IPE14.6, 22H* (DRTP*CSTP+RTP*DCSTP)	MAIN	064
	1F (LBTHD(JP) . NE.LBUFF) GO TO 900	MAIN	164
	WRITE (3,927) JP,IP,IP,JP		765
126	FORMAT(6X,2HAL,2I2,2H=-,2HAL,2I2)	MAIN	669
	*RITE (3,930) JP,1P,1P,JP	MAIN	767
930	FORMAT(6X,3HDAL,2I2,2H=-,3HDAL,2I2)	MAIN	495
006			965
1 10		2 4 4 5	- 00
104	TORMALLING STAFFORCOMPOLE INERMAL DIFFUSION FUR INE GIVEN SPECIES.)	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	B (0)
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	(I.EO.NSPC) WRI IF (3.933) ( (LH	_	208
	IF (1.E0.1.0R.1.EU.NSPC) GO TO 93%	Z A M	509

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		FORMAT(6X,5HRKT=X,1Z,4H*SUM )	_	(n)	FORMAT(6X,7HVBOI=UX,1Z,2H*I) WRITE(3,945)[	FORMAT (6X,3HUVT,12+10H=VTOP/VBOT)	If([.eO.])WKITE(3.948)((LBFL.EBUX.).LBALF'I.J.LBTL'TEGATOTEBERT'. * 1. 1+2.MSDC)	FORMAT (6X,5HDSUM=,2(AI,A2,I2,A3,ZI2,2AI,I2,A4,ZIZ),AI,	* 8(/5x,IH*,IX,2(A2,I2,A3,2I2,2A1,I2,A4,2I2	IF (I.EQ.NSPC) WRITE (3.948) ((LBPL.1-BUX.3-LB	* U+[BDALP+]+U)+U=1+NM) IF(1 FO 1 OF 1 FO NAPOVEO 10 950	IN THE FORT THE PROPERTY COOK TO THE		RITE (		CONTINUE	FORMAT (6X,7HDRKT=UX,12,6H*SUM+X,12,5H*DSUM	WRITE (3,958) I.I.I	FORMAT(6X,14HDVTOP=URKT*UVX,12,12H*DT+RKT*DUVX,12	* III*OI+XXI*OVX•I/•4F*OOI	WK11E (3+961/1+1) FORMAT (6X+9HDVBOT=DDX+12+5H*T+DX+12+3H*DT		FORMAT(6X,4HDUVT,12,34H=DVTUP/VBUT-VTOP*DVBOT/(VBOT*VBOT)	CONTINUE	WALLE (3) 1169/ FORMAT (THC. 2X, 36HFIND THE FINAL VALUES OF	DO 1130 K=I+NSPC	IF (LBTHD(K).EQ.LBOFF) WRITE(3.1132)K.K.K	IF (LBIHD (K) .NE.LBDFF ) WRITE (3.1131) KON	CONTINUE FORMATION TO SHIVE TO SHELVEN TO SHIVE TO SHIVE TO SHIVE TO SHELVEN TO SHIVE TO SHIV		DO II35 K=I+NSPC	IF(LBIMO(K).EQ.LBOFF)WKIIE(3.1138)KoKoK	IF (LBINUE) AND TROOP OF THE TOTAL STATES OF THE CONTINUE.			CONTINUE	212) ( (LBM.LBUV.K) .K=1	(6X,3HDV=+8 (AI,A2+I2)+AI	WRITE(3*1218)K+K+K FORMATAKA GUINELIO SHEHV-10 SHEHV-10)	FORMAT (6X*ZHUV*1 X* SH=UV*1 X* SH=UV*1 X
	935	936	616	5	246	945	4	948			7					952	955	,	928		196	•	796	950	1129				1130	1132			7125	1137	1138	995		1212	1215	1218

PAGE

04/15/80 13.55.29

FIN 4.8+49H

76/76 OPT=I HOUND=+-\*/ IMACE

PROGRAM LOADF

0 I

13.55.29	115	512 513	514	212	916	517	516	520	521	525	523	524	525	527	5.78 8.78	529	530	531	532	533	734	536	537	538	539	540	14.1	54C	544	545	246	247	548	676	550	552	553	554	555	556	557	558	260	561	562	563	554	565	567	
04/15/80	ZI W	MAIAM	MAIN	MAIL	MAIN	2 2 4 4 2 X					•	MA :	Z Z Z	2 2 2 2 2 2	NAM	MAIN	MAIN			Z 2	2 7 4 5	Z	MAIN	MAIN	MAIN	MAIN	2 2 4 4 5		ZZ	MAIN	MAIN	MAIN	MAIN	MAIN	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	ZIV	ZZZ	MAIN	MAIN	ZIV	Z :	Z Z Z	N I V	2	MAIN		ZIV	2 2	MAIN	
TOTAL OF THE ROUNDENS THACE FIN 4.8.498	19=1+1 WD11F(2-032) ((1940) ) HX, (200) 02.1, (1950) (1950) (1950) (1950)	* I.J.).JENSPC)	CONTINUE	WRITE(3,936) I	TOWNER TOX-STAKE TAY I CO-4H # SUM )	FOHMAT(6X*)2HVTOP=HKT*UVX*12*3H*UT)	WRITE (3.942)]	FORMAT(6X,7HVBOT=DX,12,2H*T)	WRITE (3+945) 1	FORMAT(6X,3HUVT,12,10H=VTOP/VBOT)	IF(1.EU.1)#KITE(3.948)((LBPL.LBUX.J.LBALP.I.J.LBPL.LBX.J.LBUALP.I	FORMATIKE ELICENSING STATES AND S	+	IF (1.EQ.NSPC) WRITE (3.948) ((LBPL,LBDX,J,LBALP,1,J,LBPL,)	* J.LBDALP.1.J.,-J.	IF(I.E0.I.OR.1.EQ.NSPC)GO TO 952			WRITE(3,948)((LBPL,LBOX,J,LBALP,1,J,LBPL,LBX,J,LBDALP,1,J),	. J-IOIM) * ((LBFL*LBUX*J*LBALF*IO)-LBFL*LBX*J*LBUALF*I.J)*J=]F*NSFC CONTINIF	WK) TF (3.05K) 1.1	FORMAT(6X,7HDRKT=UX,12,6H*SUM+X,12,5H*DSUM)	WRITE (3+958) I+I+I	FORMAT (6X, 14HDVTOP=URKT*UVX, 12, 12H*DT+RKT*DUVX, 12,	* IIH*DI*RKT*UVX*IZ*4H*DDT )	WRITE(3,961)1.1	OVER   1000 000   -DOV   1200   - DOV   1200   12	FORMAT(6X • 4HD)VT • 12 • 34H=DVTOP/VHOT-VTOP *)VHOT/(VBOT *VROT)	INUE	WRITE(3.1129)		DO II30 K=I+NSPC	IF (LBIHD(K).EQ.LUDFF) WRITE (3.1132) K.K.K			FORMAT (6X - 0.HI) > 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1		IF(LBTHD(K).EQ.LBOFF)WRITE(3.11.34)K.K.K						WRITE (3,1212) ((LHM+LBUV+K)+K=I+HHPC)	FURMAT(6X.3HDV=.8(A1.42.12).41.2(/5X.1H*.1X.8(A2.12.41))))	00 12	ENDMATER (3.1218) K+K+K	A NOT A	WHITE (3,1222) ((LHM+LHOUV+K)+K=1+SPC)	
TAUGRAM LUAUR			935	) ·	430	626		845	4	945		0.70								95.2	700	955		926		1 70	100	964	950		1129				1130	11132			ļ	1135	1130	11.30 905			1212		1215	0171		
Ž.	715				000	750			- (	525				530					535				540				575					550				555	)				000				565				210	

76/76 OPT=1 ROUR FORMAT(6X,4HDDV=,8(A1,A2	ROUND=+-#/ FKACE FIN 4.8+498 0	04/15/80 MAIN MAIN	13.55.29 568 569	PAGE
**************************************	•6H+!)V*DU•12•6H+DDV*U•12)	<b></b>	572 572 572	
FORMAT(6X,9HMHUV(1ST+,1Z,7H)=RH*UV,1Z) DO 810 K=1,NSPC WRITE(3,812)K,K,K	*UV*12) )RH*UV;12,7H+RH*DUV;12)	M M M M M M M M M M M M M M M M M M M	574 575 576 576	
Σ	DERIVATIVES.)	ZZZZZZ ZZZZZZ ZZZZZZ ZZZZZ	578 579 580 581	
WRITE (3.622) FORMAT (6X.15HSP=ASP+BSP*TIME) TMSPH2=TMN/(PHN*PHN) WRITE (3.628) FORMAT (IX.3H100.2X.8HCONTINUE)			0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
WRITE(3*832) FORMAT(6X*25H]F(KPUE.EQ.NPUE) GO TO WRITE(3*636) TMN FORMAT(6X*3HRY=*1PE20.IO*8H*R(KPUE) TMSPH=TMN/PHN	. 150)	ZZZZZZ ZZZZZZ ZZZZZ	5000 5000 5000 5000 5000 5000	
WRITE (3,638) TMSPH FORMAT (6X,4HDY=-,1PE20,10,16H*URHUV(IST+KPUE) WRITE (3,642) FORMAT (6X,23HFVAL=SP*UPH(KPDE)+UY+RY) WRITE (3,646) FORMAT (6X,6HRETURN)	V(IST+KPUE) ) RY)	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	2000 2000 2000 2000 2000 2000 2000 200	
### FORMAT (1X+3H)50.2X+8HCONTINUE) DO 650 K=1.NM WRITE (3+652)K+K CONTINUE FORMAT (6X+2HDU+12+5H=UPH(+12+1H) ) K=NSPC		ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	
LBUD=ZNDO WRITE(3.656)K,((LBM·LBOU.)),J=1,NM) FORMAT(6X,2HDU,IZ,1H=.8(A1,A2.IZ),A1,2(/5X,1H*,1X,8(A2,1 FORMAT(6X,3HTL=.1PE2U.10,1H*) WRITE(3.66A,3HTL=.1PE2U.10,1H*)	) Al.2(/5X•1H*•1X•B(A2•12•A1)) )	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	600 600 600 610 611	
FORMET (SX.]H*, IX.4]H (DRHLM(IC) *UPH (NPDE) +RHLM(IC) *UPH2 (NPDE) LRBL=1H LBC=6HC(1ST+ LBHHUV=10H) *RHUV(IST WPITE (3.668) TMSPH+ ((LHBL+LBPL+LHC+K+LBHHUV+LHPL+K+LHP)+K=1+	(NPDE)+RHLM(1C)*UPH2(NPDE)) ) K•L8KHUV•LRPL•K•LRP)•K=1•	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	612 613 615 615 616	
	4PUE)*(*ZAl,A6*I2*Al0*Al*12* 12*3Al)) )		617 618 619 620 671	
LBH=RH)*H(1SI* WKITF(3.672)IMSIP,((LHHL.LHPL.L»+K.LMM·N.LHP).N=1.NSPC) FORMAT(6X.4HIR=1Pt<0.10.2H*(+/(2A1,A2.12.AH.12.A1).?A1	T+ TMSTP•((LHML•LHPL•L»-«K•LMH•R•LHP)•K=1•NSPC)•LHP TR=-•1Pt20•10•2H#(«Z(2A1•A2•12•AH•12•A1)•2A1•	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	627 623 624	

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PAGE									
30 13.55.44.	LCM LENGTH								
04/15/80									
10N 1.0	17276		9000E-01						
VERSION	6Тн		7.9	222	222				
LOADER	SCM LENGTH		E+01 0.	.36945345E-14 58099162E-05 F+01 0.	22	v1SC0S1TY.	MAL CUMBUCTIVITY	v1sC0S1TY.	COMPUCTIVITY
			3.8000E+01			N 1 SC	INERMAL	V 1 ×	I + E RMAL
	241)	FILE  1.60 SL-FTNL18	9200E+00	34909973E-10 .26765200E-02 22997056E+01	.99807393E-10 12081500E-02 .23580424E+01	45	H2	N N	2N
	_	*****************	2	E+01 E+03	E-05 E+01 E+04 PAR.	2900E-U1	UF-01	0E-01	0F =0 ]
O M A P	LOADF	LENGTH 12230 130 144 10 41 41 330 454 454 173 476 173 171 16 16 16 16 16	0000E+00	.3057 .9889(	57235277E-05 .36748261E+01 10611588E+04 AR. 0000. WARNATZ ST PAR.	6.50	7.38330UF	6.613600E	7.99960uF
E 2 L 0 A	ENTERED AT LO	ADDRESS 110 12340 •/ 12341 12341 12341 12341 12551 12551 12612 12612 12612 12612 12612 12612 12612 12612 12612 14667 14667 16216 16422 16741 17150 17150 17150	THDFF 2	.51119464E-03 19629421E+01 18122739E-11 -	-28963194E+01 .15154866E-025723527 90586184E+03 .61615148E+01 .3674826 63217559E-0922577253E-121061158 VISCOSITY FROM WARNATZ ST PAR. LEAST SQUARES FIT: T=300.2000. THERMAL CONDUCTIVITIES FROM WARNATZ S LEAST SQUARES FIT: T=300.2000.	2,188700E-06	6.357900E-06	4.266700E-06	6.407700607
S C 0 P	WILL BE	LOADF /SIP.END/ /SIP.END/ /GOTO- QONIO- FCCMSK= FEIFSI= FLIUN= FLIUN= FLIUN= FLIUN= FRIAP= FORSYS= FOR	H N	01E+01 42E+03 91E-08	94E+01 . 34E+03 . 59E-09 ITY FROM . CONDUCT	H22	25	42	N2
	PHOGRAM	145	1	.31001901E+01 87738042E+03 .55210391E-08	-28963194E+01 90586184E+03 63217559E-09 VISCOSITY FRO LEAST SQUARES THERMAL CONDU	1	-	λ	5

BINARY DIFFUSION COEFFICIENTS FROM WARNALZ ST PAR. LEAST SQUARES FIT. I=100.300

~ ~	SN SN SN	5.951700E-05	5.951700E-05 1.663800E+00	H 5	N	HIMARY DIFFUSION.	
1 +	8.112200E-01 4.866900E-02 9.542600E-01 -1.435700E-01 PN = 1.0000E+03 PHN =	RTP=RT/(6C*-5) C* HCB F1T 5.0006F-05	1.53/400E=05	N Z	∾ Z	BINARY DIFFUSION.	

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00 40 0 C 00
                                                                                                                                                                                                                                                                           35
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           2.32401020E-06+T*( -6.32175590E-10+T*( -2.25772530E-13))))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          5.26442100E-08+T*( -3.49099730E-11+T*( 3.69453450E-15))))
                                                                                                                                                                                                                                                                                                                                                                                                                              5.52103910E-09+T*( -1.81227390E-12))))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             9.98073930E-I1+1*( -6.52235550E-I51)))
                                                                                                                                                                                                                                 SURROUTINE F (TIME.PH.U.UPH.UPH2.FVAL.NPDE.NPDE.IC.KSKT.KSKP)
                            COMMON/TARAB/ASP, BSP, TPN, PHN, TMN, TMSPH, TMSPH2, TMSTP, TPENI
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           5.11194640E-04/2.0+T*( 5.26442100E-08/3.0
.3.49099730E-11/4.0+T*( 3.69453450E-15/5.0)))))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                              5.52103910E-09/4.0+T*( -1.81227390E-12/5.0)))))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           H Z=1.9872*( -1.06115880E+03+T*( 3.67482610E+00
* +T*( -1.20815000E-03/2.0+T*( 2.32401020E-06/3.0
* +T*( -6.32175590E-10/4.0+T*( -2.25772530E-13/5.0)))))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              * +T*( 9.98073930E-11/4.0+T*( -6.52235550t-15/5.0)))))
                                                                                           DIMENSION C(1000) .H(1000) .RHLM(100) .DHHLM(100) .CM(100)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           H 2=1.9872*( -9.05861840E+02+1*( 2.89631940E+00 +1*( 1.51548660E-03/2.0+1*( -5.72352770E-07/3.0
                                                                                                                                                                                                                                                                                                                                                                                                                                            H 1=1,9872*( -9,88904740E+02+1*( 3,05744510E+00 +1*( 2,67652000E-03/2,0+1*( -5,80991620E-06/3,0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            C 2=1,9872*( 3,67482610E+00+T*( -1,20815000E-03
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* +1*( -5,72352770E-07+1*( 9,98073930E-11+1*( -6,
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               THERMAL CONDUCTIVITES FROM WARNATZ ST PAR.
              DIMENSION U(NPOE) , UPH (NPDE) , UPH (NPOE)
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                                                                                                                              COMMON/TARMF/RHUV (1000) • DRHUV (1000)
                                                                                                                                                                                                                                                                             TEST CASE. BINARY MIX OF HZ AND NZ.
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1			0	13.55.52
- (a.   k.   a.   a.   a.   a.   a.   a.		C LEAST SQUARES FIT, T=300,2000. C V l= Z.188700E-06*(1** 6.502900E-01) C V 2= 4.266700E-06*(1** 6.613600E-01) RL I= 6.357900F-06*(1** 7.343400E-01)		59 60 61
- u.		C LEAST SQUARES FIT. T=100.300 WARNATZ ST PAR. C LEAST SQUARES FIT. T=100.300 C PRESS = 1.00 C S.951700E-05*(T** 1.663R00E-01)		65 65 65 65 65 65 65 65
Le	•	YS=Y 3 X 1=Y 1/YS X 2=Y 2/YS U 1=U( 1) DU 1=UPH( 1)		68 69 77 72 73
<b>Le le le  Le  Le  Le  Le  Le  Le  Le  Le</b>		DDU 1=UPH2( 1) U 2=1.0-U 1 DU 2=-DU 1 DDU 2=-DDU 1 DY 1=DU 1/ 2.00		3 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
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Le		DRH=- 1.2187690433E-02*(DT/T+DYS/YS)/(T+YS) VL 1= 1.57284638E+05*(T**( -7.38330000E-01)) VL 2= 1.56062238E+06*(T**( -7.99960000E-01)) DRL 1= 4.694228E-06*(T**( -2.616700E-01))*DT DRL 2= 5.125904E-07*(T**( -2.000400E-01))*DT		98 98 98 98 98 98 98 98 98 98 98 98 98 9
Le		DVL 1= -1.161280E+05*(T**( -1.736330E+00))*DT DVL 2= -1.248435E+06*(T**( -1.799960E+00))*DT DYSY=DYS/(YS*YS) DX 1=DY 1/YS-Y 1*DYSY DX 2=DY 2/YS-Y 2*DYSY		89 90 92 93
in the lac tac tac tac tac tac tac tac tac tac t		DDY 1=DDU 1/ 2.00 DDY 2=DDU 2/ 28.00 DDYS=+DDY 1+DDY 2 DYSYSQ=(DYS/YS)**2 DDX 1=(DDY 1-2.0*DY 1*DYS/YS)/YS		96 97 94 94
a la	υ (	UUX Z=(UUY Z=Z,U*UY Z*UYS/YS+Z*U*Y Z*UYSYSU-Y Z*DOYS/YS)/YS VD 1 Z= 1.68019221E+04*(T**( -1.66380000E+00))  VD 1 Z= -2.79S50381E+04*(T**( -2.66380000E+00))  SPECIFIC HEAT OF THE MIXTURE. NT1S FORMULA.  CM(IC)=+C(1ST+ 1)*U 1+C(1ST+ 2)*U 2		99 100 102 103
. Le Le Le Le Le Le	<i>.</i> 0	AVERMED CONDUCTIVITY OF THE MIXING RULES.  AVERAGE OF LINAER AND HECIPROCAL MIXING RULES.  RLSUM=+X 1*RL 1+X 2*VL 2  RLSIV=+X 1*VL 1+X 2*VL 2  RLSIV=+X 1*LSIV  RLM=0.5*(PLSUM+RLSIV)		106 106 107 108
	ပ	RHLM(IC)=RH*RLM SPACE UER OF DENSITY TIMES THERMAL COND. ULSUM=+X 1*DRL I+UX 1*RL 1+X 2*D+L 2+UX 2*RL 2 ULSUM=+X 1*VL 1+X 1*DV 1+X 2*VL 2 ULSIV=+DX 1*VL 1+X 1*DVL I+DX 2*VL 2 ULSIV=-KLSIV*RLSIV*ULSIV		11111111111111111111111111111111111111

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FIN 4.8+498

DPT=1 ROUND=+-#/ 1HACE

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SUBROUTINE F

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13.55.5	173 174 175 176 177	179 180 181 182	184 185 186 187 188	189 190 191 192	194 195 196 197
04/15/80 13.55.52		LE LE LE LE		لم لم لد لد لم	لد ليد ليد ليد ليد
FIN 4.8+498		5		I( 1) 1 1 1C)*UPH(NPDE)*HHLM(IC)*UPH2(NPDE)) 2.000000000E+01*UPH(NPUE)*( +C(IST+ 1)*RHUV(IST+ 1) +	2)*RHUV(1ST+ 2)) 1.0000000000E-06*( +R( 1)*H(IST+ 1) +R( 2)*H(1ST+ 2)) UPH(NPDE)+(TL+TR+TD)/CM(IC)
*/ THACE	-	N	)E) JV(IST+KPDE)	) *UPH2 (NPDE) )	(( 1) *H(IST+ 1) 'CM(IC)
OPT=1 ROUND=+-*/ THACE	U 1+DDV*U 1 U 2+DDV*U 2 UV 1 UV 2 H*UV 1+RH*DUV	H*UV 2+RH*DUV AT1VES. 30 TO 150	) 00E-03*R (KPC) 0000E+01*DRHC)+DY+RY	000E+05* 4PDE)+RHLM(IC 0000E+01*UPH(	1ST+ 2)) 0000E-06#( +R)+(TL+TR+TD)/
d0 91/91	00V==DUV 1-DUV 2  0UV 1=DUV 1+DV*DU 1+D0V*U 1  0UV 2=DUV 2+DV*0U 2+D0V*U 2  RHUV(IST* 1)=RH*UV 1  RHUV(IST* 2)=RH*UV 2  DRHUV(IST* 1)=DRH*UV 2	URHUV(1ST+ 2)=DRP ND THE TIME DERIV SP=ASP+8SP*TIME CONTINUE 1F(KPDE.EO.NPDE)	RY= 1.00000000 DY=- 2.0000000 FVAL=SP*UPH(KPDE) RETURN CONTINUE	DU 1=UPH( 1) DU 2=-DU 1 TL= 4.0000000( * (URHLM(IC)*UPH(N	* C(IST+ 2)*RHUV() TR=- 1.000000 FVAL=SP*UPH(NPDE) RETURN END
SUBROUTINE F		100	150	•	•
ns	175	180	185	190	195

#### LIST OF SYMBOLS

 $A_{i,j}^* = \Omega_{i,j}^{(2,2)*}/\Omega_{i,j}^{(1,1)*}$ , quotient of collision integrals.  $B_{ij}^{*} = \left[5\Omega_{ij}^{(1,2)*} - 4\Omega_{ij}^{(1,3)*}\right]/\Omega_{ij}^{(1,1)*}, \text{ quotient of collision integrals.}$   $C_{ij}^{*} = \Omega_{ij}^{(1,2)*}/\Omega_{ij}^{(1,1)*}, \text{ quotient of collison integrals.}$  $C_{i,int}$  = internal heat capacity, cal-mole<sup>-1</sup>-K<sup>-1</sup>.  $C_{i,rot} = rotational heat capacity, cal-mole^{-1} - K^{-1}$ .  $C_{i,tr} = translational heat capacity, cal-mole^{-1} - K^{-1}$ .  $C_{i,v}$  = heat capacity at constant volume, cal-mole<sup>-1</sup>-K<sup>-1</sup>.  $c_{pi} = \text{specific heat, cal-gm}^{-1} - K^{-1}$ .  $c_p = \sum_{i=1}^{\infty} c_i Y_i$ , specific heat of the mixture, cal-gm<sup>-1</sup>-K<sup>-1</sup>.  $\mathcal{D}_{i,i}$  = binary diffusion coefficient, cm<sup>2</sup>-s<sup>-1</sup>.  $D_{im} = diffusion coefficient of species i into a mixture, cm<sup>2</sup>-s<sup>-1</sup>.$  $D_{ij}$  = multicomponent diffusion coefficient, cm<sup>2</sup>-s<sup>-1</sup>.  $D_{i}^{T}$  = multicomponent thermal diffusion coefficient, gm-s<sup>-1</sup>-cm<sup>-1</sup>.  $v_{i,int,j}$  = binary diffusion coefficient for internal energy, cm<sup>2</sup>-s<sup>-1</sup>. h; = specific enthalpy, cal-gm<sup>-1</sup>.  $k = \text{Boltzmann constant} = 1.38054 \text{X} 10^{-16} \text{ erg-K}^{-1} - \text{molecule}^{-1}$ .  $k_{ij}$  = thermal diffusion ratio.  $k_{\rm im}$  = thermal diffusion ratio between species i and the rest of the mixture. M<sub>i</sub> = molecular weight, gm-mole<sup>-1</sup>. p = pressure, atm. q = total energy flux relative to the fluid velocity, cal-cm<sup>-2</sup>-s<sup>-1</sup>.

 $R_i$  = rate of production of ith species by chemical reaction, mole-cm<sup>-3</sup>-s<sup>-1</sup>.

 $R = gas constant = 1.9872 cal-mole^{-1} - K^{-1}$ .

 $R_a = gas constant = 82.05 cm^3 - atm - mole^{-1} - K^{-1}$ .

#### LIST OF SYMBOLS (Cont'd)

t = time, s.

T = temperature, K.

 $T_{ij}$  = temperature of unburned mixture, K.

 $T_{R}$  = temperature of burned mixture, K.

 $T_i^* = T/(\epsilon_i/k)$ .

 $T_{ij}^* = T/(\varepsilon_{ij}/k)$ .

 $u = fluid velocity, cm-s^{-1}$ .

 $V_i = diffusion velocity, cm-s^{-1}$ .

 $V_i$  = diffusion velocity due to species gradients, cm-s<sup>-1</sup>.

 $W_i$  = diffusion velocity due to the temperature gradient, cm-s<sup>-1</sup>.

x =spatial coordinate, cm.

 $X_{i}$  = mole fraction.

 $Y_i = mass fraction.$ 

 $Y_{iu}$  = mass fraction of species i in the unburned mixture.

 $Y_{iB}$  = mass fraction of species i in the burned mixture.

 $\alpha_i$  = polarizibility,  $A^3$ .

 $\epsilon_{\rm i}/k$  = Lennard-Jones or Stockmayer parameter, K.

 $\eta_i$  = viscosity, poise = gm-cm<sup>-1</sup>-s<sup>-1</sup>.

 $\mu_i$  = dipole moment, debye =  $10^{-18}$  gm<sup>1/2</sup>-cm<sup>5/2</sup>-s<sup>-1</sup>.

 $\sigma_i$  = Lennard-Jones or Stockmayer parameter, A.

 $\lambda_{o}$  = thermal conductivity of the mixtures, neglecting diffusion effects, cal-cm<sup>-1</sup>-s<sup>-1</sup>-K<sup>-1</sup>.

 $\lambda_{\text{o,tr}}$  = thermal conductivity due to translational energy, cal-cm<sup>-1</sup>-s<sup>-1</sup>-K<sup>-1</sup>.

 $\lambda_{\text{o,int}}$  = thermal conductivity due to internal energy, cal-cm<sup>-1</sup>-s<sup>-1</sup>-K<sup>-1</sup>.

### LIST OF SYMBOLS (Cont'd)

 $\lambda_{\text{mix}}^{\text{mon}}$  = thermal conductivity of a mixture of monatomic gases, cal-cm<sup>-1</sup>-s-1-K-1.

 $\lambda_{mix}^{poly}$  = thermal conductivity of a mixture, cal-cm<sup>-1</sup>-s<sup>-1</sup>-K<sup>-1</sup>.

 $\rho$  = fluid density, gm-cm<sup>-3</sup>.

 $\xi_{ij}$  = rotational collision numbers.

 $\Omega_{ij}^{(1,1)*}$ ;  $\Omega_{ij}^{(2,2)*}$ ;  $\Omega_{ij}^{(1,2)*}$ ;  $\Omega_{ij}^{(1,3)*}$  = collision integral.

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